ANSES Opinion
Request No 2016-SA-0017

The Director General

Maisons-Alfort, 31 January 2017

OPINION
of the French Agency for Food, Environmental and Occupational Health & Safety

on the "analysis of the nutritional relevance of front-of-pack food labelling systems intended for consumers"

ANSES undertakes independent and pluralistic scientific expert assessments.

ANSES primarily ensures environmental, occupational and food safety as well as assessing the potential health risks they may entail.

It also contributes to the protection of the health and welfare of animals, the protection of plant health and the evaluation of the nutritional characteristics of food.

It provides the competent authorities with all necessary information concerning these risks as well as the requisite expertise and scientific and technical support for drafting legislative and statutory provisions and implementing risk management strategies (Article L.1313-1 of the French Public Health Code).

Its opinions are published on its website.
This opinion is a translation of the original French version. In the event of any discrepancy or ambiguity the French language text dated 31 January 2017 shall prevail.

On 11 December 2015, ANSES received a formal request from the Directorate General for Health (DGS), the Directorate General for Food (DGAL) and the Directorate General for Competition, Consumer Affairs and Fraud Control (DGCCRF) to undertake an expert appraisal dealing with the following: “the algorithm for the nutritional classification of foods proposed by the French Trade and Retail Federation” or 'SENS'.

Firstly, in the framework of the implementation of Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers (INCO Regulation), ANSES was asked to analyse the feasibility of calculating two algorithms for the nutritional classification of foods used for the 'SENS' and '5C' front-of-pack food labelling systems. This first stage was described in a scientific and technical support document published in March 2016 (ANSES, 2016).

Secondly, ANSES was asked to analyse the nutritional relevance of these two systems, in light of public health issues relating to nutrition.

In a letter received on 25 July 2016, the DGS, DGAL and DGCCRF asked ANSES to include a third system, 'Health Star Rating' (HSR), in its work on the nutritional relevance of various food labelling systems (amendment to Request No 2016-SA-0017).

1. BACKGROUND AND PURPOSE OF THE REQUEST

1.1. Background

Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers (INCO Regulation) sets out rules for the nutrition declaration that is mandatory on all food labels as of 13 December 2016. This mandatory declaration shall include the energy value as well as the amounts of carbohydrate, protein, fat, saturates, sugars and salt. The regulation stipulates that this declaration may be "given in other forms of expression and/or presented using graphical forms or symbols", on a voluntary basis, provided that certain requirements listed in Article 35 of the Regulation are met. In the context of this proposal, the French 'Health' Act No 2016-41 created Article L. 3232-8 of the Public Health Code stipulating: "In order to help consumers make choices regarding energy and nutrient intakes in their diet, […] the mandatory declaration provided for in the same regulation can be accompanied by an additional presentation or expression using graphical forms or symbols, under the conditions set out in Article 35 of the said regulation". These provisions concern prepacked foods[1] with the exception of food supplements, mineral water and foods for special nutritional uses.

The 2011-2015 French National Health & Nutrition Programme (PNNS) seeks to "specifically promote access to foods of good nutritional quality", by "undertaking analyses aiming to improve the food labelling provided to consumers to facilitate their choices".

According to the French High Council for Public Health, the "primary objective of implementing a front-of-pack food labelling system is to act on determinants of health, in particular by improving food consumption" (HCSP, 2015).

1.2. Purpose of the request

The public authorities are considering proposing a single system at the national level, based on the systems currently available, for use on a voluntary basis. This system will be subject to specifications set by Ministerial Decree[2].

Five systems are currently being studied for the establishment of specifications defining the format of the information supplementing the nutrition declaration that will be recommended at national level[2]. This request deals with the analysis of the nutritional relevance of various front-of-pack labelling systems. In order to answer any questions that may arise when establishing these specifications, ANSES thought it was essential for its assessment work on nutritional relevance to include the five systems under consideration: 'Nutri-Repère', 'Nutri-Couleurs', 'Nutri-Score' (5C), 'Health Star Rating' (HSR) and 'SENS'.

[1] According to the INCO Regulation, a 'prepacked food' is "any single item for presentation as such to the final consumer and to mass caterers, consisting of a food and the packaging into which it was put before being offered for sale, whether such packaging encloses the food completely or only partially, but in any event in such a way that the contents cannot be altered without opening or changing the packaging; 'prepacked food' does not cover foods packed on the sales premises at the consumer's request or prepacked for direct sale"

[2] Ministerial Decree No 2016-980 of 19 July 2016 on additional food labelling

2. ORGANISATION OF THE EXPERT APPRAISAL

The expert appraisal was carried out in accordance with French Standard NF X 50-110 “Quality in Expert Appraisals – General Requirements of Competence for Expert Appraisals (2003)”.

The collective expert appraisal was undertaken by the Expert Committee (CES) on Human Nutrition, based on the initial reports of five rapporteurs, between 9 June and 8 December 2016.

ANSES analyses interests declared by experts before they are appointed and throughout their work in order to prevent risks of conflicts of interest in relation to the points addressed in expert appraisals.

The experts’ declarations of interests are published on the ANSES website (www.anses.fr).

ANSES made sure that the experts in the committee with potential conflicts of interest with respect to the subject of the request did not attend the discussions relating to this opinion.

Hearings were held with various national organisations proposing three of the systems examined in the context of this request (SENS, 5C and HSR).

3. ANALYSIS AND CONCLUSIONS OF THE CES

3.1. Definition of nutritional relevance

The analysis of the nutritional relevance of front-of-pack labelling systems (FoPLs) first requires a precise definition. And yet nutritional 'relevance' is a very broad notion, involving the relationship between food and health and also potentially covering various aspects of nutrition, from the intrinsic characteristics of a food to its role in diet. In the framework of this appraisal, the word 'nutrition' encompasses all issues involved in the relationship between diet (nutrients, foods, contaminants, and the social, cultural, economic, sensory and cognitive determinants of dietary practices) and health determinants.

The CES considers that the objective to be achieved by implementing a FoPL for public health purposes should be to reduce the incidence of diseases in the entire population through an improvement in the nutritional quality of diets.

It has been proven that major current public health problems, such as obesity, diabetes and cardiovascular diseases, are largely related to diets and levels of physical activity. The most widely documented relationships between diet and health are those that have been found between certain types of diets or certain categories of foods and these diseases. Diets are broken down into several levels of complexity: categories of consumption, the relative consumption of food groups, the consumption of certain types of foods, intakes of nutrients and other substances contained in foods, and exposure to contaminants. The effects of diet on health are the result of interactions between the multiple components of foods, effects related to food matrices, and modes of consumption (preparation method, frequency and structure of meals, etc.). Lastly, dietary practices are the outcome of complex behaviour involving trade-offs resulting in substitutions, which means that food intakes are partly interdependent.

Furthermore, food behaviour is influenced by individual characteristics and the characteristics of the social, cultural and societal context of food and eating. Marketing and nutritional research as well as transformative consumer research (TCR) shows that these individual characteristics influence the way in which labels are read.

The CES therefore considers that the said nutritional relevance of FoPLs with regard to public health issues refers to the adequacy of the FoPL in relation to the aim of reducing the incidence of diseases in the entire population through its impact on food choices.

Thus, in order to avoid a simplistic and partial analysis, the nutritional relevance of a FoPL should be analysed by simultaneously taking into account the various levels of dietary complexity:

- **diet as a whole;**
- **foods consumed;**
- **intakes of nutrients and other substances, and exposure to contaminants.**

It should also be considered in light of the consumer's individual characteristics and the social, cultural and societal context of food.

3.2. The CES's approach

To assess the adequacy of a FoPL in relation to the objective stated above, the CES adopted a two-stage approach.

Firstly, the CES described the five systems in question and identified all of the variables that should be studied to analyse the nutritional relevance of a FoPL. The CES only took into account data allowing all of the five systems to be analysed, i.e. data related to nutrients in particular. Therefore, the CES analysed the ability of each FoPL's configuration (variables taken into account, reference values and threshold values determining classes of foods) to describe the quality of a food solely in terms of nutrients and energy.

Secondly, the CES considered the FoPLs in the context of factors likely to modify consumer behaviours in view of assessing their capacity to guide consumer behaviour for public health purposes.

3.3. Analysis of FoPL configurations

3.3.1. Description of FoPLs and of the five systems studied in the context of the request

Front-of-pack labelling systems aim to provide simple and credible information to consumers in order to, at the very least, enhance information about certain nutritional characteristics of products. There are two main types of FoPLs: evaluative and reductive (Newman *et al.*, 2014)[3] :

- reductive FoPLs factually present a selection of information about nutrient levels using figures;
- evaluative FoPLs aim to translate the nutritional quality of a product, determined by calculating a single score based on a selection of nutritional parameters. This score classifies foods in relation to one another and is represented on the packaging by a colour code, letter or symbol.

There are also intermediary systems (Figure 1):

- 'hybrid' systems that give reductive information together with a non-global evaluation (each piece of information is evaluated);
- 'dual' systems that present a single score, classifying foods in relation to each other, alongside reductive information.

[3] The literature also distinguishes between 'simple' evaluative systems and 'complex' reductive systems (Feunekes *et al.*, 2008)

The five systems studied in the context of this request were as follows:

- 'Nutri-Repère' (a reductive system) translates levels of four nutrients and energy using diagrams. It is an adaptation of the 'Guideline Daily Amounts' that currently appear on certain products in France (Hawley *et al.*, 2013);
- 'Nutri-Couleurs' (a hybrid system) assigns a colour to four nutrients and energy according to their levels in the food. It is an adaptation of the 'Traffic Light' approach developed in Great Britain for use on food labels (Hawley *et al.*, 2013);
- '5C' or 'Nutri-Score' (an evaluative system) assigns a letter and a colour to the food (on a scale ranging from A green to E red) based on the nutrients and ingredients it contains (Julia *et al.*, 2015c). It is an adaptation of the algorithm developed by the British Office of Communications (OfCom) in 2004 in order to define access to food advertising intended for children;
- 'SENS'[4] (an evaluative system) assigns a colour to the food based on the nutrients and ingredients it contains (Darmon *et al.*, 2015). This system uses the 'SAIN-LIM' algorithm of which there are various versions, each developed in a clearly defined context and for a specific use (access to nutrition and health claims, product reformulation assessments, etc.);
- 'Health Star Rating' or HSR (a dual system) shows levels of four nutrients and energy as well as an overall score indicated on the food on a scale from one-half to five stars. This system was developed in Australia and New Zealand for use on food labels (FRSC, 2016).

[4] This programme assigns a consumption frequency (very often, often, regularly in small quantities, occasionally or in small quantities) to each of the four classes as determined by an additional algorithm

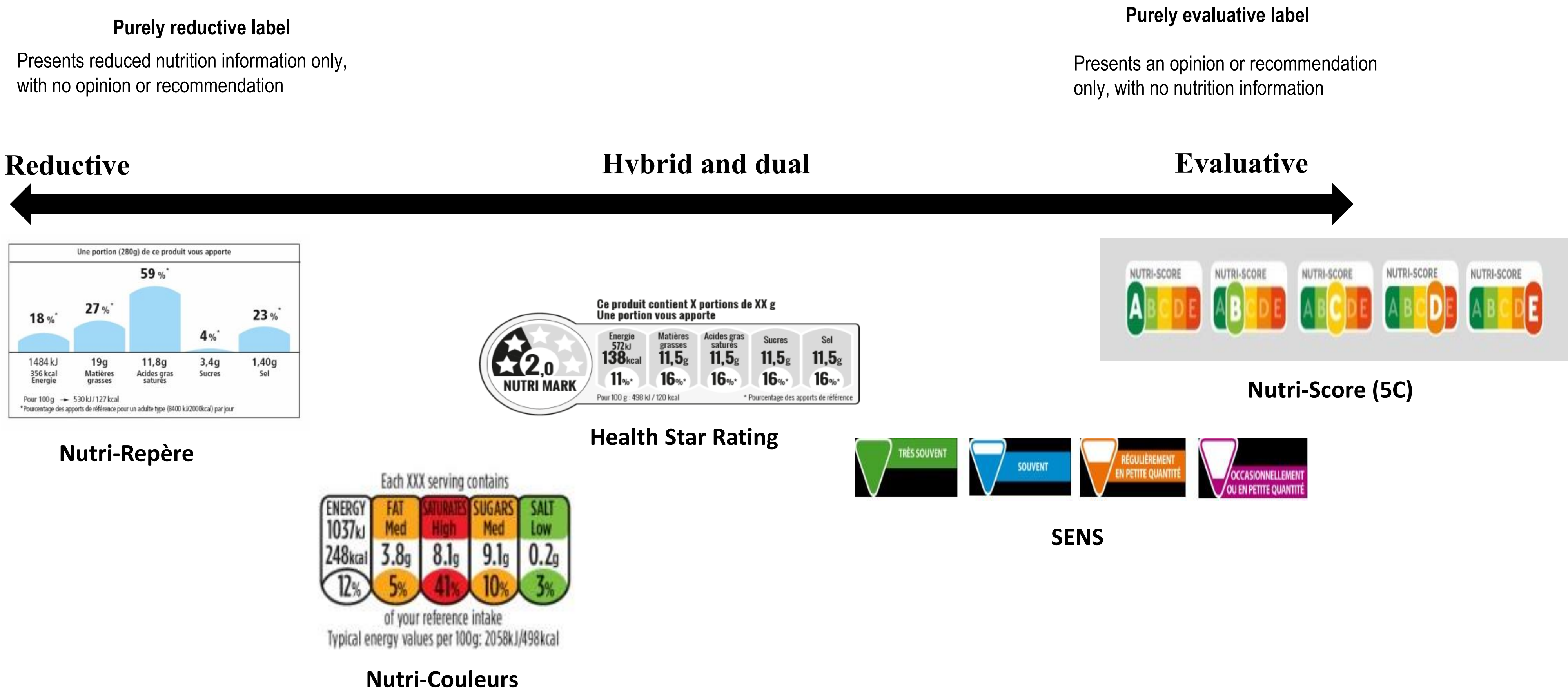

Figure 1: Typology of the FoPL formats studied in the context of the request. According to (Hamlin and McNeill, 2016).

Table 1: Short description of the five systems studied in the framework of the request

	Nutri-Repère	Nutri-Couleurs	5C	SENS	HSR
Type of system	Reductive	Hybrid	Evaluative	Evaluative	Dual
Aspects considered as positive by the system	None	None	F&V (excl. potatoes) Protein (subject to conditions) Fibre	F&V (excl. potatoes, dried F&V and oilseeds) Protein (except beverages and fat) Fibre (except beverages and fat)	F&V (incl. potatoes) Protein Fibre
Aspects considered as negative by the system	None	None	Energy Total sugars SFAs Sodium	Free sugars (added + honey, syrups, juices) SFAs Sodium	Energy Total sugars SFAs Sodium
Quantitative information	Energy Total sugars Fat SFAs Salt	Energy Total sugars Fat SFAs Salt	None	None	Energy Total sugars Fat SFAs Salt
Calculation base	Serving	100g/100mL and/or per serving*	100g/100mL	100kcal (for positive aspects excl. F&V) and 100g/100mL (for negative aspects)	100g/100mL
Presentation base	Serving	Serving	NA	NA	Serving for the reductive part NA for the evaluative part
Specific categories	None	None	Fat Beverages Cheeses	Fat Beverages Cheeses Other dairy products Egg products Cereal products Fish products	Fat Beverages Cheeses
Score calculation method	NA	NA	Point scales Negative component score – positive component score Specific calculations according to the value of the negative component, the category of food and the concentration of F&V	Weighting by DRIs (and 20 for fibre, 10 for F&V) Application of minimum and maximum thresholds to levels of certain components depending on the category of food Positioning of the two scores (positive and negative) in a diagram to determine the class	Point scales Negative component score – positive component score Specific calculations according to the value of the negative component, the category of food and the concentration of F&V
Number of classes	NA	3	5	4	10 (0.5 to 5 stars)

NA: not applicable
F&V: fruits and vegetables SFAs: saturated fatty acids
DRIs: Daily Reference Intakes (regulatory values for labels)
*If the serving size is larger than 100g or 100mL

3.3.2. FoPL configurations: variables to be considered

The establishment of a FoPL should take into account a set of variables demonstrating the 'nutritional quality' of foods.

On the smallest scale, that of the analytical characteristics (composition) of foods, it is necessary to take into account all a food's components, such as nutrients (energy-yielding macronutrients, vitamins and minerals), as well as other substances[5] such as natural trace elements for which variation in intakes is likely to have an effect on health. Since contaminants and additives found in foods can also affect health, it would theoretically be relevant to consider them as well when rating the nutritional quality of a food and designing a FoPL. That said, references for analysing the benefits or risks associated with the consumption of these nutrients, other substances, contaminants and additives are significantly lacking. Moreover, food composition data are partial or have been extrapolated from the composition of generic foods.

Thus, the establishment of a FoPL should take into account considerations of feasibility, data accessibility and reproducibility. To that end, practical choices have to be made to select a limited amount of accessible information that nonetheless remains the most 'theoretically relevant' in terms of public health. The theoretical relevance of this information can be demonstrated by the significance of redirecting intakes with the aim of improving the health of the general population. The subsequent stages in the establishment of a FoPL consist in comparing levels in a food to reference values (Daily Reference Intakes (DRIs) are the main values that are currently used). For evaluative FoPLs, an additional stage consists in aggregating nutrition information (the FoPL algorithm), which requires a specific configuration, to obtain a score that will be compared to values used to distinguish foods from one another.

[5] Under Regulation (EC) No 1925/2006 of the European Parliament and of the Council of 20 December 2006 on the addition of vitamins and minerals and certain other substances to foods: "a substance other than a vitamin or a mineral that has a nutritional or physiological effect"

3.3.3. Analysis of the ability of FoPL configurations to describe the nutritional quality of foods

In light of the available knowledge of each of the systems analysed in the context of this request, the analysis of FoPL configurations was limited to the choice of variables and reference values. The points discussed and the conclusions made in this section give no indication as to how the various types of systems impact consumer behaviour, which will be discussed in Section 3.4.

To undertake this analysis, the CES identified criteria for demonstrating the theoretical ability of a FoPL's configuration to describe the nutritional quality of a food for public health purposes.

3.3.3.1. Choice of variables

Energy

The rise of overweight and obesity in the French population is a major public health problem. Overweight is essentially the result of an energy imbalance, i.e. of energy intake exceeding energy expenditure. At the same time, certain populations in France have an inadequate energy intake. It is therefore essential to consider total energy intake. In this context, the amount of energy should be taken into account when designing a FoPL.

Nutrients

When discussing the choice of nutrients to be used to establish a FoPL, the CES took into account ANSES's most recent estimates of nutrient intakes in France to consider nutrients for which inadequate or excessive intakes are convincingly related to health events and for which there are gaps between observed intakes and recommended intakes.

Nutrients for which there are inadequate intakes

In its Opinion of 13 March 2015 on the assessment of vitamin and mineral intakes in the French population (ANSES, 2015a), ANSES estimated the prevalence of inadequate intakes and the risk of exceeding the safety limits.

This analysis showed that the risk of exceeding the safety limits is very marginal in the adult and child populations. However, there is a high prevalence of inadequate intakes of certain vitamins and minerals, primarily in people aged 75-79 years (for calcium, magnesium, selenium, potassium, and vitamins C and B6), children and adolescents aged ten to 17 years (for magnesium, calcium, copper, zinc and potassium), girls aged 13 to 17 years (for iodine and selenium) and women aged 18 to 55 years (for iron).

Regarding vitamin D, the prevalence of inadequate intake is close to 100% in adults regardless of age and gender. This result, obtained under the assumption of minimal endogenous synthesis (with a population not exposed to the sun), is comparable to those reported in the literature for other countries. This result confirms the data in the literature establishing that vitamin D requirements in the French population cannot be met by the current food supply.

ANSES's Opinion of 22 September 2015 indicates that in France, irrespective of total fat intakes, mean intakes of α-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) remain far below the recommendations (ANSES, 2015b). Regardless of age, the percentage of subjects at risk of inadequate intakes is close to 100% for ALA and 90% for the EPA+DHA pair.

The latest estimates for France show fibre intakes well below those deemed adequate, in both adults and children (AFSSA, 2009).

This information shows that minerals (iron, magnesium, calcium, potassium, copper, iodine, zinc, selenium), vitamins (D, C, B6, B9) and fibre should be considered when designing a FoPL.

Nutrients for which the population is at risk of excessive intakes

There is a range of evidence converging towards the harmful effects of high total sugar[6] intakes which makes it necessary to issue recommendations limiting sugar intakes in the population. The data currently available cannot be used to precisely establish the threshold of total sugars from which these effects appear. However, vectors of added sugars, especially sugar-sweetened beverages[7], are clearly involved in weight gain and related lifestyle diseases.

ANSES's Opinion of 22 September 2015 indicates that in France, irrespective of total fat intakes, mean intakes of atherogenic saturated fatty acids (SFAs) (lauric, myristic and palmitic acids) are above the recommendations (ANSES, 2015b). More specifically, the mean intake of these fatty acids, which is close to 10% of energy intake without alcohol (EIWO), exceeds the recommended upper value (of 8% EIWO) for adults and children. The percentage of subjects at risk of excessive intakes is thus very high, ranging from 70% to 80% of individuals (depending on the age group).

There are currently no nutritional guidelines for sodium in France. However, given the intakes observed today for a significant fraction of the population, with regard to the public health objectives, the risk of excessive sodium intakes is regarded as greater than the risk of inadequate intake. In this situation, sodium intakes should be reduced for the heaviest consumers.

This information shows that total sugars, lauric, myristic and palmitic acids, and sodium should be considered when designing a FoPL.

[6] Sugars refer to mono- and disaccharides and by analogy glucose or fructose syrups digested and/or absorbed and metabolised

[7] Sugar-sweetened beverages include sodas, nectars, fruit juices made from concentrate, fresh fruit juices, smoothies, etc.

Overall, the CES considers that, in addition to energy, the components currently to be considered in the French population with regard to nutritional risk are as follows:

Inadequate consumption:

- minerals: Mg, Ca, K, Cu, I, Zn, Se, Fe;
- vitamins D, C, B6, B9;
- fibre;
- ALA, EPA and DHA.

Excessive consumption:

- sugars;
- atherogenic SFAs (lauric, myristic and palmitic);
- sodium.

For most of these nutrients, excessive or inadequate intakes affect only a sub-group of the population. Only a few nutrients (sugars, sodium, vitamin D, DPA, DHA, ALA, atherogenic SFAs, fibre) and energy affect a large majority of population sub-groups.

There are therefore two possible approaches:

- one is exhaustive (Approach 1), considering all of these nutrients, but it risks producing a biased indicator of the nutritional quality of products in relation to the nutritional risk for each sub-group of the population;
- the other (Approach 2) considers only nutrients relevant to a large majority of population sub-groups but is incomplete for most of the sub-groups taken individually.

Tables 2 and 3 position the five studied FoPLs with regard to these two approaches.

3.3.3.2. Choice of reference values

The nutritional relevance of a FoPL depends on several factors including the robustness of the reference values used for rating the nutritional quality of foods.

When discussing the choice of reference values to be used to develop a FoPL, the CES considered the various types of available values with regard to the robustness of the data used to establish them.

Methods for establishing reference values for vitamins and minerals vary depending on the nature of the available data and the objectives (individual, specific population). Dietary reference values (DRVs) are thus established for each nutrient and by population category based on scientific data of various types (biochemistry, physiology, etc.) produced in various ways, for example using the experimental approach for the Average Requirement (AR, see definition in the Annex) or epidemiology for the Adequate Intake (AI, see definition in Annex 2).

Estimation of the AR provides target values for populations, or Population Reference Intakes (PRIs, see definition in Annex 2). However, since the AR is not known for all nutrients, population intakes are not all based on this value but can be based on other less robust data such as the AI. This corresponds to the average intake of a population or sub-group whose nutritional status is considered adequate.

The assessment of needs distinguishes between energy-yielding nutrients (carbohydrates, fat and protein) on the one hand and vitamins, minerals and other substances on the other hand. The reference value is then a range of intakes considered adequate. It is a Reference Intake Range (RI, see definition in Annex 2) most often expressed as a percentage of total energy intake.

Since they heavily depend on advances in knowledge, these reference values are not permanent.

In addition to these values established by population group, i.e. directly related to each group's requirements, Daily Reference Intakes (DRIs) are single values with regulatory value[8]. DRIs are overall values established with no clear direct link to DRVs; these values often differ in reality. Therefore, they only roughly reflect the actual requirements of the population groups under consideration.

In the context of FoPLs that are intended to provide information about the quality of products consumed by all populations, a single value is not suitable considering the multiple specific requirements of each population category for a given nutrient.

3.3.3.3. Choice of discrimination values

The nutritional relevance of a FoPL also depends on the range of values used to convert an overall food score (continuous variable) into a class (represented by a colour, a number of stars, etc.). In fact, for evaluative FoPLs that assign a value judgement to a food as a whole or to its content of a given nutrient, it is necessary to define ranges for grouping foods into classes.

The choice of these discrimination values does not seem to rely on health indicators.

[8] DRIs are listed in Annex XIII of Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers

Table 2: Consideration by the FoPLs under study of the aspects to be taken into account in the assessment of nutritional risk for all populations making up the French population (Approach 1)

Nutrients of interest	Nutri-Repère	Nutri-Couleurs	SENS	5C	HSR (reductive part)	HSR (evaluative part)
Energy	**Absolute amount (DRI)**	**Absolute amount (DRI)**	**N**	**Energy density**	**Absolute amount (DRI)**	**Energy density**
Inadequate consumption						
Vitamin B6	N	N	N	N	N	N
Vitamin B9	N	N	N	N	N	N
Vitamin C	N	N	For beverages only (DRI)	N	N	N
Vitamin D	N	N	N	N	N	N
Calcium	N	N	For cheese and dairy products only (DRI)	N	N	N
Copper	N	N	N	N	N	N
Iodine	N	N	N	N	N	N
Iron	N	N	N	N	N	N
Magnesium	N	N	N	N	N	N
Potassium	N	N	N	N	N	N
Selenium	N	N	N	N	N	N
Zinc	N	N	N	N	N	N
EPA + DHA	N	N	N	N	N	N
ALA	N	N	For fat only (AFSSA, 2001)	N	N	N
Fibre	N	N	Y (20g)	Y*	N	Y*
Excessive consumption						
Sodium	**Salt (DRI)**	**Salt (DRI)**	**Y (DRI)**	**Y***	**Salt (DRI)**	**Y***
Lauric + myristic + palmitic acids	**Total SFAs (DRI)**	**Total SFAs (DRI)**	**Total SFAs (DRI)**	**Total SFAs***	**Total SFAs (DRI)**	**Total SFAs***
Sugars	**Total sugars (DRI)**	**Total sugars (DRI)**	Free sugars (50g)	**Total sugars***	**Total sugars (DRI)**	**Total sugars***

Y: taken into account in the FoPL's design
N: not taken into account in the FoPL's design
In bold: information in the INCO mandatory declaration taken into account
In parentheses: reference value used to express the variable
* this system does not work with reference values but with discrimination values applied to each variable taken into account in the algorithm

Table 3: Consideration by the FoPLs under study of the common aspects to be taken into account in the assessment of nutritional risk for each population making up the French population (Approach 2)

Nutrients of interest	Nutri-Repère	Nutri-Couleurs	SENS	5C	HSR (reductive part)	HSR (evaluative part)
Energy	**Absolute amount (DRI)**	**Absolute amount (DRI)**	**Nutritional density**	**Energy density**	**Absolute amount (DRI)**	**Energy density**
Inadequate consumption						
Vitamin D	N	N	N	N	N	N
EPA + DHA	N	N	N	N	N	N
ALA	N	N	For fat only (AFSSA, 2001)	N	N	N
Fibre	N	N	Y (20g)	Y*	Y (NA)	Y*
Excessive consumption						
Sodium	**Salt (DRI)**	**Salt (DRI)**	**Y (DRI)**	**Y***	**Salt (DRI)**	**Y***
Lauric + myristic + palmitic acids	**Total SFAs (DRI)**	**Total SFAs (DRI)**	**Total SFAs (DRI)**	**Total SFAs***	**Total SFAs (DRI)**	**Total SFAs***
Sugars	**Total sugars (DRI)**	**Total sugars (DRI)**	Free sugars (50g)	**Total sugars***	**Total sugars (DRI)**	**Total sugars***

Y: taken into account in the FoPL's design
N: not taken into account in the FoPL's design
In bold: information in the INCO mandatory declaration taken into account
In parentheses: reference value used to express the variable
* this system does not work with reference values but with discrimination values applied to each variable taken into account in the algorithm

Regarding the reference values used, the CES points out that the DRIs very roughly reflect the actual needs of the population groups to be considered for a given nutrient of public health interest.

Regarding the integration of energy, the CES distinguishes between the various approaches used by the FoPLs under study.

The reductive FoPLs and the reductive part of the dual FoPLs provide information about the amount of energy contained in one serving of a food. The evaluative FoPLs do not provide information about the amount of total energy contained in a food but take into account either energy density (energy per 100g in 5C and HSR) or nutritional density (amount of nutrients per 100kcal for positive aspects in SENS).

Regarding nutrients, the reductive and hybrid FoPLs provide information only about those consumed excessively. The evaluative and dual FoPLs also use nutrients consumed inadequately to calculate the overall score for a food. The CES notes that they all take into account fibre and that only SENS also takes into account ALA (only for fat), calcium (only for certain dairy products) and vitamin C (only for beverages). None of the five systems take into account vitamin D or the EPA and DHA fatty acids.

In conclusion, the CES observes that none of the FoPLs studied in the framework of this request directly take into account all of the aspects considered to be of interest, whether with Approach 1 (exhaustive list) or with Approach 2 (reduced list).

3.4. Analysis of the ability of FoPLs to guide consumer behaviour

There are multiple determinants of food purchasing behaviour, in addition to the information provided by nutrition labels and therefore in addition to label reading. Indeed, food purchasing behaviour is determined by individual taste preferences, social standards, past consumption and health experiences, the active search for information, the passive receipt of information (including that disseminated by the media, doctors and peers), the price of foods, promotions, the health, nutritional and sensory quality of foods, proximity and ease of procurement, brands and packaging, and the division of time between market work, leisure activities and domestic activities (Etiévant *et al.*, 2010).

The decision to purchase depends on the balance between the expected benefits and costs: pleasure, adherence or non-adherence to social standards, effects on health and body weight, cost of purchase, and time spent searching for information and procuring and preparing the food. When sensory and nutritional preferences and levels of information are the same, consumers base their choices on their income and price.

The analysis of the ability of FoPLs to guide consumer behaviour was undertaken firstly from a theoretical standpoint, considering the mechanisms explaining the effects of labelling on consumer behaviour, and then secondly from an empirical standpoint, based on feedback and data obtained in real-life conditions. This section has been positioned in a general context and is not specific to the five systems analysed above.

3.4.1. The mechanisms explaining the effects of nutrition labelling on consumer behaviour

The mechanisms explaining the effects of nutrition labelling on consumer behaviour are shown in Figure 2.

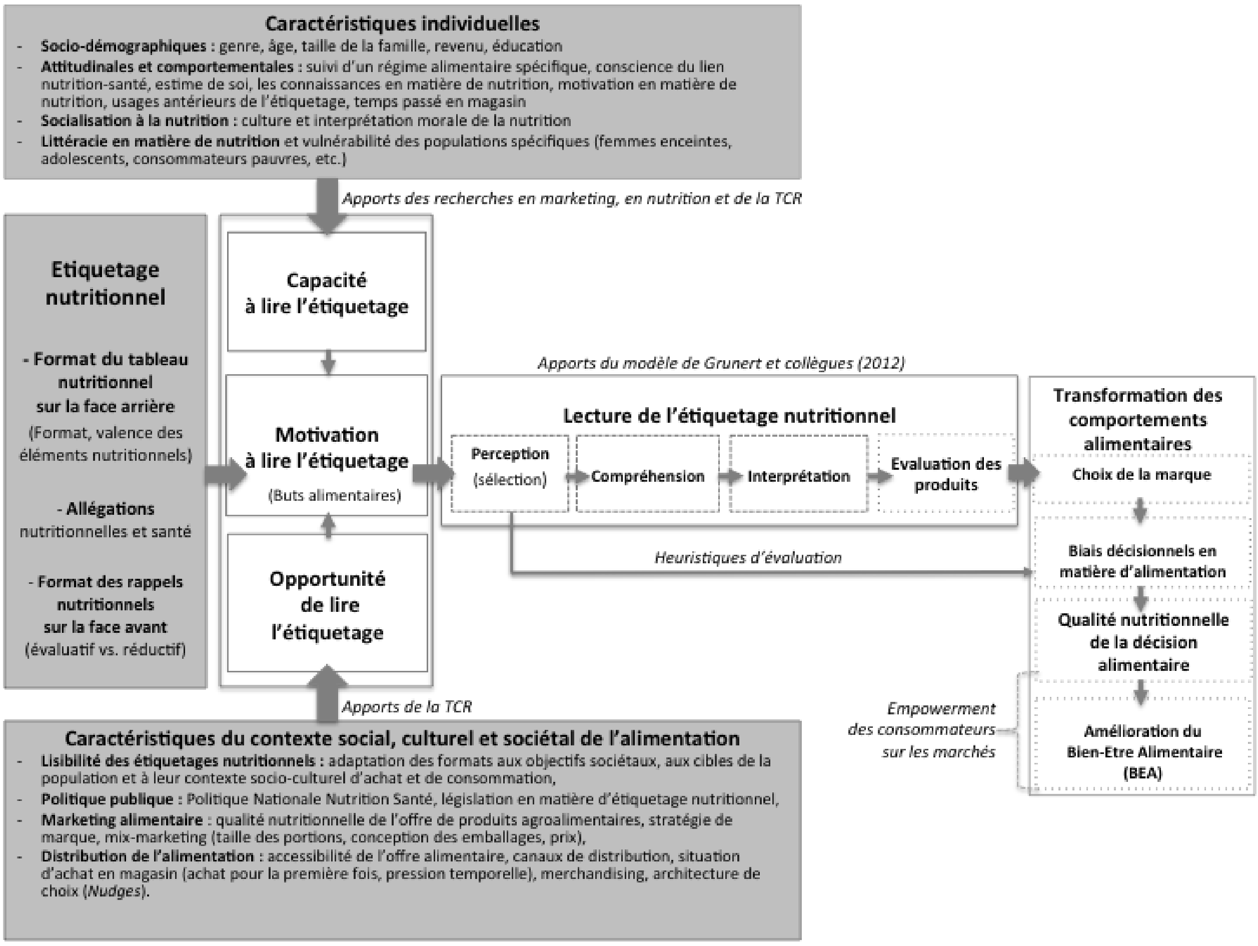

Figure 2: Mechanisms explaining the effects of nutrition labelling on consumer behaviour (Nabec, 2016)

3.4.1.1. The key factors in the effects of FoPLs on consumer behaviour: FoPL characteristics, individual characteristics and consumption context

The effects of FoPLs on consumer behaviour depend on three factors: the characteristics of FoPLs (type of FoPL and presentation format), individual characteristics, and the consumption context of individuals. These factors influence the three conditions described in the COM-B Model (Michie *et al.*, 2011): Capability, Opportunity and Motivation to change health Behaviour.

The characteristics of FoPLs

Research into the effects of FoPLs on consumer behaviour shows that they vary depending on:

- the type of presentation: evaluative or reductive (Andrews *et al.*, 2011, Feunekes *et al.*, 2008, Kleef and Dagevos, 2015, Newman *et al.*, 2014);
- the one- or multi-dimensional aspect[9] of the evaluation (Kleef and Dagevos, 2015);
- the positive or negative orientation of the nutritional message (Mérigot and Nabec, 2016, Rahkovsky *et al.*, 2013);
- the system's readability and font size (Bialkova and van Trijp, 2010, Gomez *et al.*, 2015a);
- colour: type of colour (Bialkova and van Trijp, 2010) or presence/absence of colour (Kelly, 2008, Koenigstorfer *et al.*, 2014, Muller and Ruffieux, 2011);
- the location on the packaging (Bialkova and van Trijp, 2010).

The various effects will be broken down in Section 3.4.2.

The sociodemographic, attitudinal and behavioural characteristics of individuals

FoPLs are established based on public health considerations – for the general population – but are actually intended for a variety of populations. The use of nutrition labelling varies based on the sociodemographic characteristics, attitudes[10] and behaviours of individuals.

Moreover, motivations and the ability to read labels differ depending on the population, as explained in Section 3.4.1.2.

The social, cultural and societal context of food

The food consumption context (social, cultural and societal) gives consumers a varying degree of opportunity to read nutrition labels (Block *et al.*, 2011). Reading opportunity corresponds to all the factors that lie outside individuals that make, or do not make, the adoption of certain behaviours possible (Michie *et al.*, 2011).

3.4.1.2. The determinants of nutrition label reading

The COM-B model can be applied to FoPL reading. Capability and motivation to read nutrition labels vary depending on individual characteristics, while opportunity to read nutrition labels varies depending on the consumption context of individuals.

Motivation to read nutrition labels

Motivation corresponds to internal processes that activate and guide behaviours so as to achieve a specific goal (Mook, 1995). And yet nutrition goes beyond the simple act of eating (Fischler, 2001). Nutrition has goals relating to identity, religion, ideology, human relations, culture and society that generate dilemmas in food decisions (Hausman, 2012, Souiden *et al.*, 2013, Steptoe *et al.*, 1995, Stroebe *et al.*, 2008). Food decisions differ depending on the self-regulatory focus of individuals (Aaker and Lee, 2001): some are motivated by a will to maximise the positive consequences of their diet (health, energy, pleasure) while others are driven more by a will to minimise the negative consequences (weight gain, health risk, cost).

[9] Evaluation based on one or more parameters

[10] Set of beliefs and emotions associated with a product

Individuals whose food choices are motivated by health preservation are more likely to read nutrition labels (Grunert *et al.*, 2010). They look to labels for information that will allow them to achieve their health objectives (quality labels, vitamin content, etc.). Furthermore, consumers can develop food fears, related to the processing of products, the resulting health risks (fear of being poisoned) or the construction of their identity (fear of gaining weight, of breaking a religious taboo, etc.) (Askegaard, 2003, Fischler, 2001, Rangel *et al.*, 2012, Rozin, 1999). They then deploy individual or collective behavioural resistance to certain products (Roux, 2007). Some diets are based on the total or partial avoidance of foods (vegetarian, gluten-free, GMO-free, etc.) associated with substitution (e.g. replacing cow's milk with plant-based drinks or replacing cereals containing gluten with rice) or addition (of food supplements, foods fortified with vitamins, minerals, protein, etc.) practices (Sobal *et al.*, 2006). Other diets rely on the consumption of specific food categories (halal, organic, fair trade, local, certified, etc.).

<u>Capacity to read nutrition labels and process information</u>

Nutrition label reading also depends on the ability of consumers to read and process information. It requires nutritional familiarity and competence (Yeomans, 2006): knowledge and know-how. Familiarity results in expertise (Alba and Hutchinson, 1987). Individuals with nutritional familiarity are more capable than others of reading labels and more likely to consider them in their consumption decisions (Andrews *et al.*, 2011, Burton *et al.*, 1994, Burton *et al.*, 1999, Drichoutis *et al.*, 2006, Keller *et al.*, 1997, Moorman, 1990, Nayga *et al.*, 1998). For example, knowledge of calories builds motivation to search for nutrition information and reduces the intention to purchase high-calorie products (Andrews *et al.*, 2009). However, knowledge alone cannot change behaviours: the construction of competences to act is also essential. Competences correspond to the procedural and psycho-sociological resources that individuals are capable of mobilising when they need to make a decision (Bonnemaizon and Batat, 2011, Le Boterf, 1994) and their ability to take action (Sen, 1993).

The ability of consumers to read nutrition labels is influenced by:

- *nutritional socialisation.* This refers to the learning of nutritional standards and suitable practices to make healthy food choices. It is the result of the education of individuals in their socio-cultural context (Fischler, 2001). For example, women and people with a higher income, a higher level of education or a positive attitude towards nutrition and health are thought to be more likely than other population groups to read nutrition labels (Cowburn and Stockley, 2005). The nutritional socialisation of individuals involves an ecosystem of stakeholders performing different roles in society: family, school, healthcare professionals, consumer groups, agri-food brands and public authorities. To be more effective, nutrition labelling measures should be accompanied by education campaigns on nutrition rules from a very young age (Howlett *et al.*, 2008). Labelling measures thus cannot be considered in isolation.
- *nutritional literacy*[11]*.* In the area of health, this is defined as the degree to which an individual obtains, processes and understands information and related services (Carbone and Zoellner, 2012, Rotfeld, 2009). It is complicated to acquire since nutritional balance is based on the quantities of products consumed, where certain nutrients are to be reduced and others are to be maximised, and varies between populations. People on a special diet have literacy suited to their practices (vegetarian, gluten-free, macrobiotic, locavore, etc.).

[11] According to the WHO, the concept of 'health literacy' can be defined as "the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions" (Ratzan, 2001)

Opportunity to read nutrition labels

Three key players influence the opportunity to read nutrition labels: the public authorities, agri-food brands, and retailers.

The public authorities

For the public authorities, FoPLs are presented as a driver to promote the reading of food labels. The effects of FoPLs are to be considered in the general informational context of food (among other product labelling measures for example relating to health, the environment or the quality of production channels), which is complex and dense. In fact, there are multiple regulatory provisions that apply without prejudice to one another, making it possible to juxtapose various types of information for the same food product, such as:

- labels relating to quality, the origin or the production method;
- nutrition and health claims for which the nutrient profiles[12] mentioned in Article 4 of the regulation on claims[13] have not yet been formalised in an implementing text. This situation is likely to result in a combination of apparently conflicting information appearing on the same product (e.g. an unfavourable FoPL and a health claim).

The complexity of the context is increased by factors related to the regulatory scope for the use of FoPLs. On the one hand, the regulations limit their use to prepacked products on a voluntary basis. Thus, the same store could sell similar or even identical products with only the prepacked versions bearing the information (e.g. meats cut to order at the meat counter or bulk fresh fruits and vegetables, as opposed to prepacked meat or prepared, frozen or canned fruits and vegetables). As such, analogous products with no FoPL could be subject to positive or negative discrimination. On the other hand, the regulations stipulate that operators can use the FoPL of their choice (the 'voluntary information' defined in Article 36 of the INCO Regulation), provided that the European Commission has deemed it compliant with the criteria set out in the INCO Regulation.

Brands

The opportunity to read nutrition labels is influenced by marketing. When they establish food prices, packaging and packaging sizes for example, brands influence food choices and amounts consumed (Argo and White, 2012, Chandon, 2010, Parker and Lehmann, 2014, Shah *et al.*, 2014b, Van Ittersum and Wansink, 2012). They can also encourage nutrition label reading by adopting a position focused on nutrition and the quality of food purchasing decisions (regional label, local food, slow food, organic farming, fair trade, etc.) (Chalamon and Nabec, 2013).

Retailers

Retailers can also promote the opportunity to read nutrition labels. For example, choice architecture in a store, through the organisation of a product range, the layout of shelves and the showcasing of nutrition information at the point of sale, is a driver to increase time spent in the store, reduce time pressure felt while shopping, and improve the use of nutrition labels (Grunert and Wills, 2007, Mandal, 2010, Nayga *et al.*, 1998).

Understanding the influence of public authorities, brands and retailers is therefore a priority in improving the reading of nutrition labels and its effects on eating habits.

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[12] According to Regulation (EU) No 1924/2006, the nutrient profile of a product is an appropriate criterion for determining whether the product can bear claims. The application of nutrient profiles as a criterion would aim to avoid a situation where nutrition or health claims mask the overall nutritional status of a food product, which could mislead consumers when trying to make healthy choices in the context of a balanced diet.

[13] Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods.

3.4.1.3. Food label reading quality

Reading allows individuals to decipher symbols in order to take ownership of the meaning of a text produced and structured by a third party. Grunert's model (Grunert *et al.*, 2012) illustrates the cognitive processing of nutrition labels, which is divided into four successive stages:

- perception, which is, by nature, selective;
- understanding;
- interpretation (inferences made);
- use in evaluating the product.

Each stage depends on the previous one. Decision-making is the result of the inferences made by consumers about the product's characteristics, based on their understanding of the nutritional concepts behind the nutrition information perceived on the label. For example, based on their understanding of the concept of calories and the related information perceived on the label, consumers make inferences about the healthy nature of the product that will lead them to decide whether or not to consume it.

These stages are influenced by the characteristics of the nutrition label, the motivation and capacity of individuals to read it, and the socio-cultural context of consumers. The reading process influences the quality of consumers' food decisions.

At the same time, food decisions are also underpinned by complex neurophysiological mechanisms with which external information, such as FoPLs, interferes.

3.4.2. Analysis of the effects of FoPLs: results of studies undertaken on FoPLs and feedback

The wide variety of FoPLs, many of which are systems belonging to brands and retailers, makes it difficult to evaluate their effects. Having several different FoPLs on the same market makes them complicated to use for consumers (IOM, 2012).

Regardless of their characteristics, front-of-pack food labelling systems influence consumer attitudes (all of the beliefs and emotions associated with a product) towards the products bearing them (Kees *et al.*, 2014). The effect of labelling systems on attitudes and purchase intentions is stronger when consumers are familiar with their format (van Herpen *et al.*, 2012), but there is no consensus as to the direction of this effect (increasing or decreasing according to the nutritional quality of products). Some empirical evidence seems to suggest that red has a stronger impact on consumer choices than green[14] (Balcombe *et al.*, 2010). In a study on the classification and choice of products bearing 'Traffic Light' nutrition labels, consumers were more likely to avoid choosing products with labels containing more red than they were to prefer those with more green (Cowburn and Stockley, 2005). An interpretation of this result lies in the prospect theory (Kahneman and Tversky, 1979) that losses (health risk here) carry more weight than gains (health benefit here) in the utility function of agents (consumer choices here). However, other authors show that three-colour labelling (green, neutral or red) could lower the nutritional quality of trolleys for more consumers than two-colour labelling (green, neutral) (Muller and Ruffieux, 2011).

Studies were undertaken comparing the effect of adding colour (going from monochromatic to polychromatic) in initially reductive systems (indicating the amounts of various nutrients and

[14] Consumers are more willing to pay to switch, for a given product, from a red label to an orange label than from an orange label to a green label.

percentages of reference intakes per day) (Kelly *et al.*, 2008, Koenigstorfer *et al.*, 2014). Kelly *et al.* (2008) showed that the polychromatic system was considered easier to use and allowed for foods to be more accurately and rapidly classified based on their nutritional quality, especially for consumers with a lower socio-economic status. However, in the study by Koenigstorfer *et al.* (2014) examining the choices of consumers in an experimental supermarket, the polychromatic FoPL had a zero or negative impact on time spent in front of products, depending on the type of product. Adding colour to a FoPL does not influence the choices of all consumers, but it allows consumers with low self-control[15] to choose better nutritional quality in a category of products. This effect does not occur for consumers showing high self-control.

The majority of existing evaluations deal with intermediary variables, such as consumer evaluations of the nutritional quality of products, their perceived characteristics, consumer attitudes towards nutrition labelling, perceived value[16], the credibility of nutrition labels, motivation to read and take into account nutrition labels, and product purchase intentions (Drichoutis *et al.*, 2012, IOM, 2012). These data, collected through a questionnaire or in a laboratory, are obtained by developing a specific protocol and require the recruitment of participants. The main limitations of these methods are related to the declarative nature of the responses or the non-payment of the chosen products. Furthermore, when evaluations deal with a specific category of products, the results cannot be extrapolated to other product classes.

[15] Self-control: influence of willpower over emotions (source: French Academy)

[16] In marketing, perceived value is the value assigned to a product or service in the minds of consumers

3.4.2.1. Studies undertaken with reductive FoPLs

Reductive formats provide a summary of the main nutrient values. They are perceived by consumers as more 'credible'[17] than evaluative formats (Feunekes *et al.*, 2008). They meet the expectations of consumers who, generally speaking, prefer a simplified presentation of information but also want factual, non-coercive information (Grunert and Wills, 2007). Studies report that reductive FoPLs do not generally influence choices or preferences between products in the same category, in a multiple-choice context (Aschemann-Witzel *et al.*, 2013, Van Wezemael *et al.*, 2014).

There are studies on the frequency of nutrition information reading in the natural context of dense and complex consumption. The study by Grunert *et al*. (2010) stated that only 8.8% of the French people in the study read the Guideline Daily Amounts shown on the front of products when they go shopping. The Nutrition and Health Barometer of the National Institute for Prevention and Health Education (INPES) undertaken in 2008 reported that of the 4051 people interviewed, 44.1% said they read nutrition information on packaging "systematically for all products" or "systematically for certain products", and 16.7% "from time to time". The use of nutrition labels varies depending on the socio-demographic characteristics of individuals, and label reading is varied and selective depending on food consumption goals (Chalamon and Nabec, 2015). Targets with a low level of education are less able to understand numerical formats than others (Viswanathan and Childers, 1997, Viswanathan *et al.*, 2009). The influence of reductive FoPLs is low for consumers with limited geographical access or economic resources for purchasing 'healthier' foods (IOM, 2012). The use of these labels is somewhat limited to a set of people with high awareness of nutrition and its issues, referred to as the 'nutritional elite' (Andrews *et al.*, 2009). There are data indicating that in the United States, where the nutrition declaration has been mandatory since the Nutrition Labeling Education Act (1990), only consumers already motivated by health issues related to nutrition use it (Balasubramanian and Cole, 2002, Keller *et al.*, 1997).

Moreover, consumers use evaluation heuristics[18] when dealing with agri-food products, allowing them to reduce the cognitive effort required to read nutrition labels. These selective shortcuts can cause inference biases, preventing consumers from accurately assessing the nutritional qualities of products (Andrews *et al.*, 1998, Kozup *et al.*, 2003, Savoie *et al.*, 2013). Two main inference biases were identified in the literature:

- a negativity - or generalisation - bias that consists in overestimating the negative aspects of a product, for example fat or sugars, even if they occur in small quantities (Rozin *et al.*, 1996, Rozin and Royzman, 2001). It is the result of thought contagion and stereotypes associated with certain categories of food products (Oakes and Slotterback, 2005, Rozin *et al.*, 1996). It has a negative halo effect on the whole product whose positive aspects are not taken into consideration. Individuals then evaluate the product more negatively than it actually is.
- a positivity bias - or positive halo effect - that consists in overestimating the positive aspects of a product (such as natural ingredients or vitamins), which prompts consumers to generalise the product's evaluation without taking the negative aspects into consideration (Chalamon and Nabec, 2015, Wansink *et al.*, 2009). For example, the number of calories consumed is underestimated (Parker and Lehmann, 2014, Shah *et al.*, 2014a) and the product is evaluated as being nutritionally better than it actually is (Scaife *et al.*, 2006). For individuals watching their weight, having healthy foods, e.g. a salad, in a high-calorie meal can paradoxically cause them to underestimate the number of calories consumed (Chernev, 2011).

[17] The question used to estimate this parameter was: In your opinion, how credible is this health indicator? The answers ranged from "not at all credible" to "extremely credible"
[18] Cognitive processes or mental shortcuts for the selective processing of information

Other biases were identified in the literature: the simplification of nutrition information (a more readable presentation for example) reduces the cognitive processing of information and makes products more appealing, irrespective of their nutritional quality (Gomez *et al.*, 2015b).

In addition, hedonic preferences are thought to be given more value at the time of purchase than health information. For example, information about the reduced fat content of butter and its health benefits can reduce consumer willingness to pay for this product (Saulais and Ruffieux, 2012).

3.4.2.2. Studies undertaken with evaluative and hybrid FoPLs

Hybrid and evaluative systems are described as being more suitable for the decision-making context of rapid in-store purchasing (Feunekes *et al.*, 2008, Newman *et al.*, 2014). Studies on the understanding of the '5C' and 'Traffic Lights' FoPLs show that these systems improve the capacity of consumers to classify foods according to the nutritional quality described by the FoPL (Ducrot *et al.*, 2015, Kelly *et al.*, 2008). Other evaluative formats, such as the 'Smart Choice' synthetic logo, can generate a bias in the evaluation of products (Andrews *et al.*, 2011, Gomez *et al.*, 2015b). In particular, products bearing this logo are perceived as containing fewer negative components (calories, fat and salt) and as being healthier than products without it (Andrews *et al.*, 2011). Labels that combine a hybrid or evaluative format and a reductive format ('Traffic Lights' and 'Guideline Daily Amounts') are thought to have less of a halo effect and greater accuracy in the evaluation of nutritional quality than evaluative logos such as 'Smart Choice' (Andrews *et al.*, 2011, Siegrist *et al.*, 2015).

There is no consensus regarding the effects of hybrid and evaluative FoPLs on purchases or purchase intentions.

Muller and Ruffieux assessed, as part of an experimental plan, the effects of seven types of FoPLs on the nutritional quality of the virtual shopping carts of 364 consumers (Muller and Ruffieux, 2011). The subjects were invited to choose products (either inclusively from 273 products, or from one of the 35 product categories) on a computer interface, before and after labels were added. The experiment showed that, on the whole, nutrition labels improved the nutritional quality of the shopping carts of 68% of the subjects (average for all the groups). Coloured labels (with a green or red dot or with no dot) placed on products across the board were more effective on average (LIM[19] reduced by 14.6%) than labels with a single logo (with a green dot or no dot) (LIM reduced by 10.8%). Coloured labels placed on a specific category of foods were more effective for individuals with the lowest incomes. However, opposite effects to those expected were found for all of the FoPLs (20% of subjects lowered the nutritional quality of their shopping cart during the experiment). Coloured labels generated more opposite effects to those expected than labels with a single logo. Lastly, for 12% of the subjects, no change in nutritional quality was observed during the experiment.

Hamlin *et al*. evaluated the impact of the 'Traffic Light' and 'Recommended Daily Intake' systems on the purchase intentions for breakfast cereals of 250 students (Hamlin *et al.*, 2014). They showed that the presence of a label – no matter what type – increased product purchase intentions, regardless of the nutritional status of the products.
These results are in contrast with those of Hamlin and McNeill evaluating the impact of the 'Health Star Rating' system on consumer choices of breakfast cereals, using an experimental plan with a sample of 1200 consumers (Hamlin and McNeill, 2016). Two types of breakfast cereals were proposed, of low or high nutritional quality and with or without a label. Two assumptions were tested: (1) The presence of the HSR label influences consumer choices; (2) Consumer choices are

[19] LIM: 'Limited Nutrient Score' calculated from levels of sodium, saturated fatty acids and added sugars in a food

modulated by the rating (from 0.5 to five stars) expressed by the label. The experiment showed that consumers preferred cereals of lower nutritional quality regardless of the rating expressed by the label. The presence of the label reduced purchase intentions for both types of cereals. According to the authors, these results were due to the fact that consumers are more frequently exposed to nominal (brand) or binary (absence or presence) information on packaging, and are thus trained to respond to such information (presence or absence of a label) rather than gradual information (various levels).

Julia *et al.* undertook a study in an experimental supermarket, where they assessed the nutritional quality of the shopping carts of 901 participants, who did not pay for their purchases at the end (Julia *et al.*, 2016). The products proposed were breakfast cereals, sweet biscuits and appetisers, to which the '5C' FoPL was added, with or without information presenting the system (two '5C' groups), or to which no front-of-pack FoPL was added (control group). There was no significant difference between the overall nutritional quality of the shopping carts of the '5C' group and the control group. The only statistically significant result in this study involved the category of sweet biscuits, for which the nutritional quality of the shopping carts of the '5C' group with information presenting the system was higher[20] than that of the control group participants.

There are fewer evaluations based on the analysis of consumer purchasing behaviour in stores. The available 'point-of-sale' retailer panel data relate to product prices, quantities purchased, and product characteristics (brands, labels, specific features and/or qualities).

Sacks *et al.* analysed quantities of ready meals and cold sandwiches purchased from a retailer, four weeks before and after the implementation of the 'Traffic Light' FoPL in the United Kingdom (Sacks *et al.*, 2009). They showed that for ready meals, overall sales increased by 2.5% ($p=0.03$) in the four-week period after the introduction of the FoPL compared to four weeks before. However, no connection was made between the nature of the FoPL and changes in purchases. For sandwiches, there was no significant change in sales.

Two studies evaluated the impact of the introduction of the 'Guiding Stars' FoPL on quantities purchased (Cawley *et al.*, 2015, Sutherland *et al.*, 2010) after displaying the logo on shelves instead of directly on the front of products. Sutherland *et al.* (2010) showed that purchases of products with the 'Guiding Stars' FoPL increased for two years after its introduction. Cawley *et al.* (2015) showed that purchases of certain product categories, whose nutritional quality was lower, decreased. Potential purchase delay was not analysed.

Vyth *et al.* examined shopping carts and distributed a questionnaire to 404 participants as they were leaving the store (Vyth *et al.*, 2010). The study results showed that individuals watching their weight and looking for information purchased more products with a 'Choices' logo while individuals attentive to hedonic aspects purchased fewer such products.

To the CES's knowledge, no evaluations have reported the impact of FoPLs on food consumption. As for health indicators, some observational studies have shown that the spontaneous diets that correspond to the most unfavourable FoPL scores are positively associated with BMI (Julia *et al.*, 2015a), metabolic syndrome (Julia *et al.*, 2015b), and the risk of developing certain cancers (Donnenfeld *et al.*, 2015) or cardiovascular diseases (Adriouch *et al.*, 2016). However, these studies were not designed to examine the health effects of FoPLs. They provide *a posteriori* observations on diets adopted spontaneously (with no FoPL) by the study populations. In that sense, they simply link scores calculated *a posteriori* to health events in adult populations. Therefore, these results in no way presuppose the effects of introducing FoPLs.

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[20] Based on the Food Standards Agency (FSA) score: control = 21.01±2.57; logo only = 20.5±2.82; logo + information = 20.23±2.67

In conclusion, the available studies indicate that reductive FoPLs are perceived as more 'credible' than evaluative formats and that, when consumers are under time pressure, hybrid and evaluative FoPLs are generally more readable and better understood. However, there is no consensus regarding their effects on choices, purchase intentions or purchases, which are the deciding factors when assessing the effects of a FoPL. Some studies show a (positive or negative) effect related to the presence or absence of FoPLs, irrespective of the information given about the nutritional quality of products.

3.5. Discussion

The effects of introducing FoPLs depend on several factors presented in the CES's analysis.

Overall, based on the available data, it is not possible to link food classification from the use of FoPLs to changes in actual choices or health determinants for all populations. Given the many factors, which are not currently controlled, determining the effects of FoPLs, the CES has identified limitations to the use of FoPLs and even adverse effects and opposite effects to those expected.

3.5.1. FoPLs are not adequately configured to achieve public health objectives

The CES considers that the objective to be achieved when using a FoPL for public health purposes should be to reduce the incidence of diseases in the entire population through an improvement in the nutritional quality of diets.

The main diseases currently targeted by public health policies are those related to overweight and obesity which are caused by an energy imbalance in relation to total energy intake. Purely evaluative FoPLs take this aspect into account in the calculation of overall scores for foods, which is directly based on energy density or indirectly based on nutrient density. With this type of FoPL, information on total energy is thus partly integrated but is not presented as such to consumers, who therefore cannot use it to adapt their food intakes.

While the qualitative approach that underlies the establishment of FoPLs aims to prevent diseases related to excesses or deficiencies for certain identified nutrients, purely evaluative FoPLs do not inform consumers of the nutrient(s) responsible for the nutritional imbalance, whereas reductive FoPLs provide this information for some nutrients. For example, consumers comparing two foods based on their FoPL cannot know whether the FoPL for one of the two foods is more unfavourable due to the amount of sodium (and its potential effect on blood pressure), sugars (and their potential cardiometabolic effect) or other excessive or inadequate nutrients. In addition, the FoPL does not provide an interpretation of the class based on the degree of health risk.

The CES observes that none of the FoPLs studied in the framework of this request directly take into account all of the aspects considered to be of interest in the French population.

The CES also notes that the nutrients taken into account in FoPLs, in particular reductive and hybrid FoPLs, are essentially those consumed in excess by a majority of the population. The CES has questions about the potential effects of the partial and biased nature of this information.

To characterise levels of certain nutrients in foods in order to demonstrate their nutritional quality, FoPLs compare these levels to reference values or value scales chosen by the FoPL designers themselves. The CES observes that the majority of FoPLs use the DRIs defined in the regulations as reference values. In order to achieve public health objectives, it is necessary to consider the specific requirements of various population types with regard to their physiological situation, by using the most robust reference values in terms of their establishment. These values are dietary reference values that apply to various population groups (in particular based on gender, age, physiological status and physical activity). And yet there is such a wide variety of situations that it is not possible to produce a single value for each nutrient that is tailored to the public health issues of populations.

Regarding the values used by evaluative FoPLs to divide foods into classes (i.e. assign a colour or number of stars to them, for example), the CES points out that, to its knowledge, the choice of these discrimination values does not rely on health indicators.

3.5.2. FoPLs do not take into account the integration of foods into the total diet or the consumption context

By design, FoPLs reflect certain nutritional characteristics of foods considered individually but do not position them as part of a total diet.

Indeed, nutrient levels in a food are evaluated in relation to reference values that do not take into account the food's level of consumption and therefore its actual contribution to total nutrient intake in the diet; they also do not consider the role of this food vehicle in relation to other contributing foods in diets. And yet the nutritional characteristics of a food are meaningful only in terms of their actual contribution to the balance achieved as part of a total diet. This is a structural incapacity of any information system reduced to the scale of isolated foods with no connection to diet.

Furthermore, purely evaluative FoPLs display a final value judgement without indicating the criteria used to define the overall nutrient profile of the food. In addition, these systems limit the cognitive effort that would allow consumers to access more accurate information about the product's nutritional characteristics. Thus, evaluative FoPLs can divert consumers from more detailed information about the reason for a low nutrition rating (an excessive or inadequate amount of a nutrient in a food), which means they are unable to rebalance their total diets accordingly.

Moreover, there are risks of counter-productive effects, which could lead for example to the exclusion of foods, the exclusive consumption of a type of food, or unfounded compensation.

It has been shown, regardless of the type of FoPL, that consumers who read FoPLs when shopping can have various possible responses. For example, there are negativity biases that lead some consumers to overestimate the negative nature of the partial information provided by the FoPL and extrapolate it to the entire food or even the category of food. These biases can result in elimination diets and do not promote nutritional balance. Conversely, this same negative information provided by the FoPL can suggest that the product tastes better (since it contains more fat and/or sugar and/or salt) and thus guide the purchases of consumers driven by hedonic preferences.

Individual characteristics, the context, as well as negativity or positivity biases related to FoPLs determining consumption can differ from those determining purchasing, especially when the consumer is not the buyer. Thus, results on the effects of FoPLs at the time of purchase cannot be directly transposed to the effects of FoPLs on the consumption of purchased foods. And yet the data currently available only take into account the effects of FoPLs during purchasing. There is therefore no information on how FoPLs affect food consumption.

Overall, the CES identified two major pitfalls. Firstly, foods cannot balance each other out in relation to the ratings assigned to them by the FoPL by design. Secondly, it is not known whether the establishment of a total diet based on FoPLs for foods can lead to a diet corresponding to the food-based dietary guidelines. Yet public information and education strategies on nutrition and health rely on food-based dietary guidelines.

By giving opinions of foods, FoPLs are likely to bring about changes in levels of food consumption in diets whereas by design, they are independent of individual food consumption characteristics (frequency and amounts consumed). It has been shown that consumers who read FoPLs when shopping can have various possible responses. The reading of a favourable FoPL could encourage consumption and thus increase energy intakes. Indeed, consumers are not able to estimate how much more of a food that has been chosen to the detriment of another food with a less favourable FoPL can actually be consumed, with a risk of excessive consumption to make up for feelings of guilt.

It should also be noted that the nutritional characteristics that are supposed to be reflected by a FoPL can be altered depending on a food's mode of consumption. The nutritional composition of a purchased food is not necessarily the same as that of this food as consumed. For example, the addition of sugar, salt or fat can reduce or neutralise the theoretical benefit expected on the basis of FoPLs at the time of purchase and thus bias the evaluation of certain products for which the addition of sugar, salt or fat is standard practice. Lastly, the level of consumption and the addition of sugar, salt or fat can be negatively influenced by favourable FoPL information. Consumers for example may add even more salt, sugar or fat to a food that has a positive FoPL rating, or consume more of it.

3.6. Conclusions of the CES

The CES considers that the objective to be achieved by implementing a FoPL for public health purposes should be to reduce the incidence of diseases in the entire population through an improvement in the nutritional quality of diets[21].

The CES notes that the operational implementation of FoPLs adheres to principles of pragmatism and simplification. While the very partial criteria for establishing FoPLs can be analysed to attempt to assess certain aspects of nutritional relevance, the CES considers that this analysis cannot be used to fully determine the potential effects of FoPLs on population health determinants, even though these would attest to their relevance.

The CES considers that the FoPL approach is at odds with the fundamental complexity of the relationships between food and health, which should be assessed by simultaneously taking into consideration diet as a whole, foods consumed, intakes of nutrients and other substances, and exposure to contaminants. The CES observes that FoPLs are limited to the scale of nutrient intakes and take into account only a few nutrients. Moreover, the nutritional composition of a food is meaningful only in terms of its actual contribution to the balance achieved as part of a diet. This is a structural incapacity of any information system reduced to the scale of isolated foods with no connection to diet.

Furthermore, the purchasing and consumption decisions that FoPLs aim to influence depend on multiple physiological, psychological and sociological factors whose weights with regard to their respective influences cannot be evaluated in the current state of knowledge. The CES has also highlighted mechanisms that can limit the effects of FoPLs and even have adverse effects. On the one hand, all types of FoPLs are associated with halo effects that bias the overall interpretation of product characteristics by consumers. On the other hand, evaluative FoPLs, which result in a single summary value criterion, could divert consumers from more detailed information allowing them to make multiple choices taking into account the composition of products. This is of particular concern for information on energy levels in foods. Alone, they thus do not allow consumers to make decisions within the context of a diet and could promote unwarranted compensation between the classes of a given FoPL.

Nutrition labelling is only one of the many determinants of purchasing behaviour. Of them, price and marketing actions seem to be favoured, especially in the least privileged sociocultural categories. However, the data are inadequate to estimate the relative contributions of these various determinants and therefore the weight of nutrition labels in purchasing decisions in relation

[21] The word 'diet' is used here in the broadest sense, i.e. meaning all of the food an individual eats, and not in the sense of restrictive eating behaviour with a particular purpose (low-calorie diet for example).

to all other determinants, depending on the social, cultural and educational characteristics of individuals. The relevance of a FoPL as a behaviour-guiding tool has thus not been proven in view of the multiple determinants of consumer choices.

The effects of FoPLs should also be considered in the general informational context of food, which is complex and dense. FoPLs are combined with other product labelling measures (relating to health, the environment or the quality of production channels). The consequences of increasing the amount of front-of-pack information on the readability, understanding and use of FoPLs by consumers should be assessed.

Ultimately, in the current state of knowledge, the nature and extent of changes in health indicators that may be induced by introducing a FoPL cannot be anticipated.

Lastly, the CES considers that nutrition information to be favoured for public health purposes should be proposed on the broader scale of food-based dietary guidelines tailored to the needs of various populations. The goal is to enable consumers to make food choices allowing them to achieve an overall nutritional balance. Directing the attention of consumers to foods taken in isolation could divert them from this objective and compromise real nutritional education.

4. AGENCY CONCLUSIONS AND RECOMMENDATIONS

ANSES adopts the conclusions of the CES on Human Nutrition and supplements them below. This opinion deals with the analysis of the nutritional relevance of food labelling systems (FoPLs), five of which were specifically examined in the framework of this request: 5C, SENS, HSR, Nutri-Repère and Nutri-Couleurs.

According to the CES, the nutritional relevance of a FoPL corresponds to its ability to reduce the incidence of diseases in the entire population by means of its effects on food choices. Nutrition labelling should therefore, in addition to being a tool for the dissemination of information about the nutritional characteristics of products, allow consumers to integrate this information in order to improve their eating habits in the long term.

Some observational data make a theoretical connection between the health of the population and the consumption of foods potentially better rated by certain FoPLs, to support a demonstration of their virtual effectiveness. However, this type of data cannot be used to confirm the actual effectiveness of a FoPL, which should be assessed over time and under real-life conditions, taking into account the multiple determinants of purchasing and consumption behaviour.

Regarding the nutritional parameters of FoPLs, the CES's analysis shows that none of the five examined FoPLs can be described as relevant with regard to current public health issues. Furthermore, ANSES notes that certain choices of nutrients are based on nutritional considerations that could be revised in light of current knowledge. In fact, data not appearing in the mandatory nutrition declaration are accessible and regularly updated in the national database of CIQUAL, managed by ANSES. These data, combined with manufacturer knowledge of product recipes, would enable nutrients of greater public health relevance to be taken into account in the configuration of FoPLs.

Evaluative FoPLs propose a classification scale whose discrimination values do not appear to be founded on public health indicators. Moreover, the classification scales of certain systems have been designed based only on statistically 'balanced' distributions, i.e. subject to changes in the food supply to the detriment of public health determinants (ANSES, 2015c). ANSES also notes that one of the secondary objectives sometimes mentioned when implementing FoPLs is to encourage manufacturers to reformulate their products. And yet, in view of the design principles of the evaluative FoPLs examined, the nutritional effects of such a reformulation resulting in the shift to a more 'favourable' class remain hypothetical.

Regarding the SENS system, as promoted by the French Trade and Retail Federation, ANSES underlines that this assessment did not examine the issue of consumption frequencies that accompany the four classes of the system, since it is specific to this FoPL. Nonetheless, ANSES stresses that it is extremely complicated to model diets and has questions about the scientific validity of translating a food classification score into a consumption frequency.

ANSES notes that the implementation of FoPLs is part of an incompletely deployed European regulatory context[22] despite its strong precedence and its strategic nature with regard to nutrition. For example, operators can fortify foods with certain nutrients with no regulatory maximum limit without having to justify that this is warranted in terms of public health. Therefore, the promotion of certain nutrients or other substances by FoPLs could encourage fortification and therefore increase intakes of vitamins and minerals in consumers who already have adequate or even excessive intakes. ANSES also underlines that some of the examined systems do not seem to fulfil all of the criteria set in Article 35 of the INCO Regulation making their deployment possible, such as information facilitating consumer understanding.

In addition, ANSES considers that the design of the examined FoPLs, in terms of both the mobilisation and the combination of variables, is not nutritionally relevant. The capacity of the examined FoPLs to improve consumer choices thus appears uncertain, and ANSES does not rule out the possibility of such food labelling systems resulting in consumption behaviours with contradictory effects.

In the current state of knowledge, the examined food labelling systems do not seem suited to the public health issues of overweight and obesity, metabolic disorders, cardiovascular diseases and certain cancers.

The Agency points out that the latest results from OQALI do not indicate any improvement in the nutritional quality of food. Therefore, in light of the public health issues related to food, it would be desirable, besides charters of commitment and the implementation of FoPLs, deployed in a voluntary context, to consider implementing effective measures, of a regulatory nature if appropriate, targeting strategic pairs of nutrient vehicles[23] or involving the regulation of advertising, in particular for children[23, 24].

In the context of the deployment of nutrition labelling provided for in the regulations, the implementation of a relevant FoPL therefore appears to be a support measure, as part of the necessary continuum of education, information and regulatory actions.

Given the challenges associated with the implementation of a FoPL, ANSES insists on the need to regularly monitor and evaluate the impacts of the labelling system that is chosen.

Dr Roger GENET

[22] Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutritional and health claims made on foods and Regulation (EC) No 1925/2006 of the European Parliament and of the Council of 20 December 2006 on the addition of vitamins and minerals and of certain other substances to foods

[23] "Propositions pour un nouvel élan de la politique nutritionnelle en France" (Hercberg, 2013)

[24] "Set of recommendations on the marketing of foods and non-alcoholic beverages to children" (WHO, 2016)

KEYWORDS

Etiquetage des aliments; allégations; déclaration nutritionnelle ; comportement du consommateur ; systèmes d'information nutritionnelle ; profilage nutritionnel ; apports nutritionnels ; déterminants d'achat ; références nutritionnelles

Food label; claims; nutrition facts panel; consumer behaviour; front-of-pack nutrition labels; nutrition profiling; nutrient intake; purchasing influences; dietary reference values

REFERENCES

Aaker, and Lee. 2001. "“I” seek pleasures and “we” avoid pains: The role of self-regulatory goals in information processing and persuasion." *Journal of Consumer Research* 28 (1):33-49.

Adriouch, Julia, Kesse-Guyot, Mejean, Ducrot, Peneau, Donnenfeld, Deschasaux, Menai, Hercberg, Touvier, and Fezeu. 2016. "Prospective association between a dietary quality index based on a nutrient profiling system and cardiovascular disease risk." *Eur J Prev Cardiol* 23 (15):1669-76. doi: 10.1177/2047487316640659.

Afssa. 2009. Etude individuelle nationale des consommations alimentaires (INCA 2) 2006-2007. Rapport de l'Agence Française de Sécurité Sanitaire des Aliments. février 2009.

Alba, and Hutchinson. 1987. "Dimensions of consumer expertise." *Journal of consumer research* 13 (4):411-454.

Andrews, Burton, and Kees. 2011. "Is simpler always better? Consumer evaluations of front-of-package nutrition symbols." *Journal of Public Policy & Marketing* 30 (2):175-190.

Andrews, Netemeyer, and Burton. 1998. "Consumer generalization of nutrient content claims in advertising." *Journal of Marketing* 62 (4):62-75.

Andrews, Netemeyer, and Burton. 2009. "The nutrition elite: do only the highest levels of caloric knowledge, obesity knowledge, and motivation matter in processing nutrition ad claims and disclosures?" *Journal of Public Policy & Marketing* 28 (1):41-55.

Anses. 2010. Evaluation des rsiques liés aux pratiques alimentaires d'amaigrissement. Rapport d'expertise collective. l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail. Novembre 2010.

Anses. 2015a. Avis de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail relatif à l'évaluation des apports en vitamines et minéraux issus de l'alimentation non enrichie, de l'alimentation enrichie et des compléments alimentaires dans la population française : estimation des apports usuels, des prévalences d'inadéquation et des risques de dépassement des limites de sécurité. Saisine n°2012-SA-0142. 13 mars 2015.

Anses. 2015b. Avis de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail relatif aux « Apports en acides gras de la population vivant en France. Comparaison aux apports nutritionnels conseillés définis en 2010 ». Saisine n°2014-SA-0117. 22 septembre 2015.

Anses. 2015c. Évaluation de la faisabilité du calcul d'un score nutritionnel tel qu'élaboré par Rayner et al. Rapport d'appui scientifique et technique. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail. Mars 2015.

Anses. 2016. Faisabilité de la classification des aliments selon l'algorithme proposé par la FCD. Comparaison des résultats obtenus à ceux du système 5-C intégrant les ajustements du HCSP. Rapport d'appui scientifique et technique (Saisine 2015-SA-0253). Mars 2016.

Argo, and White. 2012. "When do consumers eat more? The role of appearance self-esteem and food packaging cues." *Journal of Marketing* 76 (2):67-80.

Aschemann-Witzel, Grunert, van Trijp, Bialkova, Raats, Hodgkins, Wasowicz-Kirylo, and Koenigstorfer. 2013. "Effects of nutrition label format and product assortment on the healthfulness of food choice." *Appetite* 71:63-74. doi: http://dx.doi.org/10.1016/j.appet.2013.07.004.

Askegaard. 2003. "Social marketing and consumers' experience of lipophobia." *International Journal of Consumer Studies* 27 (3):232-232.

Balasubramanian, and Cole. 2002. "Consumers' Search and Use of Nutrition Information:The Challenge and Promise of the Nutrition Labeling and Education Act." *Journal of Marketing* 66 (3):112-127. doi: 10.1509/jmkg.66.3.112.18502.

Balcombe, Fraser, and Falco. 2010. "Traffic lights and food choice: A choice experiment examining the relationship between nutritional food labels and price." *Food Policy* 35 (3):211-220. doi: 10.1016/j.foodpol.2009.12.005.

Bialkova, and van Trijp. 2010. "What determines consumer attention to nutrition labels?" *Food Quality and Preference* 21 (8):1042-1051.

Block, Grier, Childers, Davis, Ebert, Kumanyika, Laczniak, Machin, Motley, and Peracchio. 2011. "From nutrients to nurturance: A conceptual introduction to food well-being." *Journal of Public Policy & Marketing* 30 (1):5-13.

Bonnemaizon, and Batat. 2011. "Les représentations managériales des compétences du consommateur: la co-création de valeur est-elle toujours possible? Le cas des consommateurs d'énergie." Association Française de Marketing.

Burton, Biswas, and Netemeyer. 1994. "Effects of alternative nutrition label formats and nutrition reference information on consumer perceptions, comprehension, and product evaluations." *Journal of Public Policy & Marketing*:36-47.

Burton, Garretson, and Velliquette. 1999. "Implications of accurate usage of nutrition facts panel information for food product evaluations and purchase intentions." *Journal of the Academy of Marketing Science* 27 (4):470-480.

Carbone, and Zoellner. 2012. "Nutrition and health literacy: a systematic review to inform nutrition research and practice." *Journal of the Academy of Nutrition and Dietetics* 112 (2):254-265.

Cawley, Sweeney, Sobal, Just, Kaiser, Schulze, Wethington, and Wansink. 2015. "The impact of a supermarket nutrition rating system on purchases of nutritious and less nutritious foods." *Public Health Nutr* 18 (1):8-14. doi: 10.1017/s1368980014001529.

Chalamon, and Nabec. 2013. "Les pratiques de lecture des étiquettes nutritionnelles: une analyse sémiotique des représentations des règles de nutrition/Nutrition labelling reading strategies: a semiotic analysis of nutritional rules representations." *Décisions Marketing* (70):59.

Chalamon, and Nabec. 2015. "Why Do We Read On-Pack Nutrition Information so Differently? A Typology of Reading Heuristics Based on Food Consumption Goals." *Journal of Consumer Affairs*. doi: 10.1111/joca.12093.

Chandon. 2010. "Calories perçues : l'impact du marketing." *Cahiers de Nutrition et de Diététique* 45 (4):174-179. doi: http://dx.doi.org/10.1016/j.cnd.2010.02.007.

Chernev. 2011. "The Dieter's Paradox." *Journal of Consumer Psychology* 21 (2):178-183. doi: http://dx.doi.org/10.1016/j.jcps.2010.08.002.

Cowburn, and Stockley. 2005. "Consumer understanding and use of nutrition labelling: a systematic review." *Public Health Nutr* 8 (1):21-8.

Darmon, Maillot, Braesco, and Tafournel. 2015. "Groupe de travail "Algorithme du SENS". L'Algortithme du Système d'Etiquetage Nutritionnel Simplifié (SENS) : développement, description et validation, 15 décembre 2015.".

Donnenfeld, Julia, Kesse-Guyot, Mejean, Ducrot, Peneau, Deschasaux, Latino-Martel, Fezeu, Hercberg, and Touvier. 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 (10):1702-10. doi: 10.1017/S0007114515003384.

Drichoutis, Lazaridis, and Nayga Jr. 2006. "Consumers' use of nutritional labels: a review of research studies and issues." *Academy of marketing science review* 2006:1.

Drichoutis, Nayga, and Lazaridis. 2012. "Nutritional Labeling." In *The Oxford Handbook of the Economics of Food Consumption and Policy*.

Ducrot, Méjean, Julia, Kesse-Guyot, Touvier, Fezeu, Hercberg, and Péneau. 2015. "Objective understanding of front-of-package nutrition labels among nutritionally at-risk individuals." *Nutrients* 7 (8):7106-7125. doi: 10.3390/nu7085325.

Etiévant, Bellisle, Dallongeville, Etilé, Guichard, Padilla, and Romon-Rousseaux. 2010. "Les comportements alimentaires. Quels en sont les déterminants? Quelles actions, pour quels effets." *Expertise Scientifique Collective: Paris, France: Institut national de la Recherche Agronomique (INRA)*.

Feunekes, Gortemaker, Willems, Lion, and Van Den Kommer. 2008. "Front-of-pack nutrition labelling: testing effectiveness of different nutrition labelling formats front-of-pack in four European countries." *Appetite* 50 (1):57-70.

Fischler. 2001. *L'homnivore*. Paris: Odile Jacob.

FRSC. 2016. Guide for industry to the Health Star Rating Calculator (HSRC). Juin 2016. Food Regulation Standing Committee of the Australia and New Zealand Food Regulation Ministerial Council

Gomez, Werle, and Corneille. 2015a. "The pitfall of nutrition facts label fluency: easier-to-process nutrition information enhances purchase intentions for unhealthy food products." *Marketing Letters*:1-13.

Gomez, Werle, and Corneille. 2015b. "The pitfall of nutrition facts label fluency: easier-to-process nutrition information enhances purchase intentions for unhealthy food products." *Marketing Letters*. doi: 10.1007/s11002-015-9397-3.

Grunert, Bolton, and Raats. 2012. "Processing and acting on nutrition labeling on food." *Transformative consumer research for personal and collective well-being* 26:333.

Grunert, Fernández-Celemín, Wills, genannt Bonsmann, and Nureeva. 2010. "Use and understanding of nutrition information on food labels in six European countries." *Journal of Public Health* 18 (3):261-277.

Grunert, and Wills. 2007. "A review of European research on consumer response to nutrition information on food labels." *Journal of Public Health* 15 (5):385-399.

Hamlin, and McNeill. 2016. "Does the Australasian “Health Star Rating” Front of Pack Nutritional Label System Work?" *Nutrients* 8 (6):327. doi: 10.3390/nu8060327.

Hamlin, McNeill, and Moore. 2014. "The impact of front-of-pack nutrition labels on consumer product evaluation and choice: An experimental study." *Public Health Nutrition* 18 (12):2126-2134. doi: 10.1017/S1368980014002997.

Hausman. 2012. "Hedonistic rationality: Healthy food consumption choice using muddling-through." *Journal of Business Research* 65 (6):794-801. doi: 10.1016/j.jbusres.2010.12.018.

Hawley, Roberto, Bragg, Liu, Schwartz, and Brownell. 2013. "The science on front-of-package food labels." *Public Health Nutr* 16 (3):430-9. doi: 10.1017/S1368980012000754.

HCSP. 2015. Avis relatif à l'information sur la qualité nutritionnelle des produits alimentaires. Haut Conseil de la santé publique, 25 juin 2015.

Howlett, Burton, and Kozup. 2008. "How modification of the nutrition facts panel influences consumers at risk for heart disease: The case of trans fat." *Journal of Public Policy and Marketing* 27 (1):83-97. doi: 10.1509/jppm.27.1.83.

IOM. 2012. Front-of-package nutrition rating systems and symbols: promoting healthier choices. edited by The National Academies Press. Washington DC: IOM (Institute of Medecine).

Julia, Blanchet, Méjean, Péneau, Ducrot, Allès, Fezeu, Touvier, Kesse-Guyot, Singler, and Hercberg. 2016. "Impact of the front-of-pack 5-colour nutrition label (5-CNL) on the nutritional quality of purchases: An experimental study." *International Journal of Behavioral Nutrition and Physical Activity* 13 (1). doi: 10.1186/s12966-016-0416-4.

Julia, Ducrot, Lassale, Fezeu, Mejean, Peneau, Touvier, Hercberg, and Kesse-Guyot. 2015a. "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. doi: 10.1016/j.ypmed.2015.08.022.

Julia, Fezeu, Ducrot, Mejean, Peneau, Touvier, Hercberg, and Kesse-Guyot. 2015b. "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 (10):2355-61. doi: 10.3945/jn.115.213629.

Julia, Kesse-Guyot, Ducrot, Péneau, Touvier, Méjean, and Hercberg. 2015c. "Performance of a five category front-of-pack labelling system - the 5-colour nutrition label - to differentiate nutritional quality of breakfast cereals in France." *BMC public health* 15:179. doi: 10.1186/s12889-015-1522-y.

Kahneman, and Tversky. 1979. "Prospect theory: An analysis of decisions under risk." Econometrica.

Kees, Royne, and Cho. 2014. "Regulating front-of-package nutrition information disclosures: A test of industry self-regulation vs. other popular options." *Journal of Consumer Affairs* 48 (1):147-174. doi: 10.1111/joca.12033.

Keller, Landry, Olson, Velliquette, Burton, and Andrews. 1997. "The effects of nutrition package claims, nutrition facts panels, and motivation to process nutrition information on consumer product evaluations." *Journal of Public Policy & Marketing*:256-269.

Kelly. 2008. FOP food labelling. Traffic light labelling gets the green light

Kelly, Hughes, Chapman, Louie, Dixon, Crawford, King, Daube, and Slevin. 2008. Front-of-pack food labelling : traffic light labelling gets the green light. Sydney: Cancer Council.

Kleef, and Dagevos. 2015. "The growing role of front-of-pack nutrition profile labeling: A consumer perspective on key issues and controversies." *Critical reviews in food science and nutrition* 55 (3):291-303.

Koenigstorfer, Groeppel-Klein, and Kamm. 2014. "Healthful food decision making in response to traffic light color-coded nutrition labeling." *Journal of Public Policy & Marketing* 33 (1):65-77.

Kozup, Creyer, and Burton. 2003. "Making Healthful Food Choices: The Influence of Health Claims and Nutrition Information on Consumers' Evaluations of Packaged Food Products and Restaurant Menu Items." *Journal of Marketing* 67 (2):19-34.

Le Boterf. 1994. *De la compétence. Essai sur un attracteur étrange*. Paris: Les Editions d'Organisation.

Mandal. 2010. "Use of food labels as a weight loss behavior." *Journal of Consumer Affairs* 44 (3):516-527.

Mérigot, and Nabec. 2016. "Les effets d'alerte et de promotion des logos nutritionnels sur la face avant des packagings des produits agroalimentaires." *Décisions Marketing* (83).

Michie, van Stralen, and West. 2011. "The behaviour change wheel: a new method for characterising and designing behaviour change interventions." *Implementation Science* 6 (1):1.

Mook. 1995. *Motivation: The organization of action*: WW Norton.

Moorman. 1990. "The effects of stimulus and consumer characteristics on the utilization of nutrition information." *Journal of Consumer Research* 17 (3):362-374.

Muller, and Ruffieux. 2011. "Do price-tags influence consumers' willingness to pay? On the external validity of using auctions for measuring value." *Experimental Economics* 14 (2):181-202.

Nabec. 2016. "Améliorer les comportements alimentaires avec l'étiquetage nutritionnel: vers un agenda de recherche au service du Bien-être des consommateurs." *Recherche et Applications en Marketing*.

Nayga, Lipinski, and Savur. 1998. "Consumers' use of nutritional labels while food shopping and at home." *Journal of Consumer Affairs* 32 (1):106-120.

Newman, Howlett, and Burton. 2014. "Shopper response to front-of-package nutrition labeling programs: potential consumer and retail store benefits." *Journal of Retailing* 90 (1):13-26.
Oakes, and Slotterback. 2005. "Too good to be true: Dose insensitivity and stereotypical thinking of foods' capacity to promote weight gain." *Food Quality and Preference* 16 (8):675-681. doi: http://dx.doi.org/10.1016/j.foodqual.2005.03.010.
Parker, and Lehmann. 2014. "How and When Grouping Low-Calorie Options Reduces the Benefits of Providing Dish-Specific Calorie Information." *Journal of Consumer Research* 41 (1):213-235.
Rahkovsky, Lin, Lin, and Lee. 2013. "Effects of the Guiding Stars Program on purchases of ready-to-eat cereals with different nutritional attributes." *Food Policy* 43:100-107. doi: 10.1016/j.foodpol.2013.08.013.
Rangel, Dukeshire, and MacDonald. 2012. "Diet and anxiety. An exploration into the Orthorexic Society." *Appetite* 58 (1):124-132.
Ratzan. 2001. "Health literacy: communication for the public good." *Health promotion international* 16 (2):207-214.
Rotfeld. 2009. "Health information consumers can't or don't want to use." *Journal of Consumer Affairs* 43 (2):373-377.
Roux. 2007. "La résistance du consommateur: proposition d'un cadre d'analyse." *Recherche et applications en marketing* 22 (4):59-80.
Rozin. 1999. "Food is fundamental, fun, frightening, and far-reaching." *Social Research*:9-30.
Rozin, Ashmore, and Markwith. 1996. "Lay American conceptions of nutrition: dose insensitivity, categorical thinking, contagion, and the monotonic mind." *Health Psychol* 15 (6):438-47.
Rozin, and Royzman. 2001. "Negativity Bias, Negativity Dominance, and Contagion." *Personality and Social Psychology Review* 5 (4):296-320. doi: 10.1207/s15327957pspr0504_2.
Sacks, Rayner, and Swinburn. 2009. "Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK." *Health Promotion International* 24 (4):344-352. doi: 10.1093/heapro/dap032.
Saulais, and Ruffieux. 2012. "A field experiment to design healthier foods: Consumer valuation of butter production processes." *Food Quality and Preference* 26 (2):178-187. doi: http://dx.doi.org/10.1016/j.foodqual.2012.04.011.
Savoie, Barlow Gale, Harvey, Binnie, and Pasut. 2013. "Consumer perceptions of front-of-package labelling systems and healthiness of foods." *Can J Public Health* 104 (5):e359-63.
Scaife, Miles, and Harris. 2006. "The impact of optimistic bias on dietary behavior." In *The Psychology of Food Choice*, edited by Sheperd R and Raats MM. Wallingford.
Sen. 1993. "Capability and Well-Being." In *The Quality of Life*, edited by Nussbaum and Sen. Oxford: Clarendon Press.
Shah, Bettman, Ubel, Keller, and Edell. 2014a. "Surcharges plus unhealthy labels reduce demand for unhealthy menu items." *Journal of Marketing Research* 51 (6):773-789.
Shah, Bettman, Ubel, Keller, and Edell. 2014b. "Surcharges Plus Unhealthy Labels Reduce Demand for Unhealthy Menu Items." *Journal of Marketing Research* 51 (6):773-789. doi: 10.1509/jmr.13.0434.
Siegrist, Leins-Hess, and Keller. 2015. "Which front-of-pack nutrition label is the most efficient one? The results of an eye-tracker study." *Food Quality and Preference* 39:183-190. doi: http://dx.doi.org/10.1016/j.foodqual.2014.07.010.
Sobal, Bisogni, Devine, and Jastran. 2006. "The impact of optimistic bias on dietary behavior." *Frontiers in Nutritional Science* 3:1.
Souiden, Abdelaziz, and Fauconnier. 2013. "Nutrition labelling: Employing consumer segmentation to enhance usefulness." *Journal of Brand Management* 20 (4):267-282. doi: 10.1057/bm.2012.14.
Steptoe, Pollard, and Wardle. 1995. "Development of a measure of the motives underlying the selection of food: the food choice questionnaire." *Appetite* 25 (3):267-284.
Stroebe, Mensink, Aarts, Schut, and Kruglanski. 2008. "Why dieters fail: Testing the goal conflict model of eating." *Journal of Experimental Social Psychology* 44 (1):26-36.

Sutherland, Kaley, and Fischer. 2010. "Guiding Stars: the effect of a nutrition navigation program on consumer purchases at the supermarket." *Am J Clin Nutr* 91. doi: 10.3945/ajcn.2010.28450C.

van Herpen, Seiss, and van Trijp. 2012. "The role of familiarity in front-of-pack label evaluation and use: A comparison between the United Kingdom and The Netherlands." *Food Quality and Preference* 26 (1):22-34.

Van Ittersum, and Wansink. 2012. "Plate size and color suggestibility: the Delboeuf Illusion's bias on serving and eating behavior." *Journal of Consumer Research* 39 (2):215-228.

Van Wezemael, Caputo, Nayga, Chryssochoidis, and Verbeke. 2014. "European consumer preferences for beef with nutrition and health claims: A multi-country investigation using discrete choice experiments." *Food Policy* 44:167-176. doi: 10.1016/j.foodpol.2013.11.006.

Viswanathan, and Childers. 1997. "'5' Calories or 'Low' Calories? What Do We Know About Using Numbers or Words to Describe Products and Where Do We Go From Here?" *Advances in Consumer Research* 24:412-418.

Viswanathan, Hastak, and Gau. 2009. "Understanding and Facilitating the Usage of Nutritional Labels by Low-Literate Consumers." *Journal of Public Policy & Marketing* 28 (2):135-145. doi: 10.1509/jppm.28.2.135.

Vyth, Steenhuis, Roodenburg, Brug, and Seidell. 2010. "Front-of-pack nutrition label stimulates healthier product development: a quantitative analysis." *International Journal of Behavioral Nutrition and Physical Activity* 7 (1):1-7. doi: 10.1186/1479-5868-7-65.

Wansink, Just, and Payne. 2009. "Mindless Eating and Healthy Heuristics for the Irrational." *American Economic Review* 99 (2):165-69. doi: doi: 10.1257/aer.99.2.165.

Yeomans. 2006. "The role of learning in development of food preferences." *Frontiers in nutritional science* 3:93.

ANNEX 1: REQUEST LETTERS

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MINISTERE DES AFFAIRES SOCIALES, DE LA SANTE ET DES DROITS DES FEMMES

Direction générale de la santé

MINISTERE DE L'AGRICULTURE, DE L'AGROALIMENTAIRE ET DE LA FORET

Direction générale de l'alimentation

MINISTERE DE L'ÉCONOMIE, DE L'INDUSTRIE ET DU NUMERIQUE

Direction générale de la concurrence, de la consommation et de la répression des fraudes

Paris, le 11 DEC. 2015

Le Directeur général de la santé

Le Directeur général de l'alimentation

La Directrice générale de la concurrence, de la consommation et de la répression des fraudes

à

Monsieur le Directeur général de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail

Objet : Saisine relative à l'algorithme de classification nutritionnelle des aliments proposé par la Fédération des entreprises du commerce et de la distribution.

PJ : présentation du système SENS par la FCD le 27 octobre 2015
PJ attendue pour fin novembre : document descriptif de l'algorithme proposé par le groupe d'experts mis en place par la FCD.

Le PNNS prévoit dans son axe stratégique 1 de réduire par des actions spécifiques les inégalités sociales de santé dans le champ de la nutrition au sein d'actions générales de prévention. Pour parvenir à cet objectif, il prévoit de « favoriser l'accessibilité à des aliments de bonne qualité nutritionnelle » et notamment (action 3.1) « la poursuite des analyses visant l'amélioration de l'information du consommateur sur le plan nutritionnel afin de faciliter ses choix ».

Le projet de loi de santé prévoit, dans son article 5 et sous réserve des exigences prévues à l'article 35 du règlement européen (UE) n°1169/2011 du 25 octobre 2011 concernant l'information des consommateurs sur les denrées alimentaires (INCO), que les formes d'expression et de présentation fixées par INCO pour la déclaration nutritionnelle obligatoire puissent être complétées, sur un mode volontaire, par une forme d'expression ou de présentation exprimée sous d'autres formes et/ou présentée au moyen de graphiques ou symboles en complément des mots ou chiffres.

Vous avez rendu en mars 2015, suite à la saisine du Directeur général de la santé en date du 17 avril 2014 relative au score nutritionnel des aliments, un rapport d'appui scientifique et technique sur l'évaluation de la faisabilité du calcul d'un score nutritionnel tel qu'élaboré par Rayner et al. Une saisine ultérieure d'avril 2015 du Haut conseil de la santé publique (HCSP), dont le rapport a été remis en août 2015, a eu pour objet de déterminer par une analyse de santé publique les seuils les plus pertinents du score nutritionnel tel qu'élaboré par Rayner et al.

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Depuis le mois de mars 2015, à la demande de la ministre des affaires sociales, de la santé et des droits des femmes, un groupe de concertation se réunit régulièrement. Il comprend, outre les administrations concernées, divers acteurs économiques de la grande distribution, dont la Fédération des entreprises du commerce et de la distribution (FCD), l'ANIA, des associations de consommateurs et de patients, des scientifiques. Son objectif est de dégager des éléments de convergence pour la mise en place en France d'un système volontaire, conforme aux dispositions prévues à l'article 5 du projet de loi santé. Lors de la sixième réunion de ce groupe en octobre 2015, la FCD a présenté une proposition de système d'étiquetage nutritionnel simplifié (SENS). Il est basé sur un algorithme, élaboré par le groupe d'experts réuni par la FCD (Mme Nicole Darmon, INRA, M. Mathieu Maillot, société MS-Nutrition et Mme Véronique Braesco, société VAB Nutrition). Il est fondé sur une classification nutritionnelle des aliments en 4 classes, d'après le score SAIN/LIM[1] modifié. Vous trouverez ci-joint la présentation faite par la FCD de son système. L'explication détaillée de la construction de cette classification a été demandée à la FCD pour fin novembre 2015.

Ce système a pour objet de mettre en place un étiquetage simplifié transversal applicable à l'ensemble des aliments. Il doit être évalué par l'Anses, au même titre que le score nutritionnel élaboré par Rayner[2]: appréciation unique globale de l'aliment, transparence du processus de calcul, disponibilité des données sur les nutriments constitutifs. Ce système doit, de plus, permettre au consommateur de comparer la qualité nutritionnelle entre groupes d'aliments, entre les familles au sein d'un même groupe d'aliments et entre les références produits. Il doit aussi être incitatif pour permettre une amélioration de la qualité nutritionnelle des produits alimentaires mis sur le marché.

Dans un premier temps, il est demandé à l'ANSES :

- d'analyser, à l'occasion de la mise en œuvre du règlement UE n°1169/2011 dit INCO, et au regard de l'information nutritionnelle sur la composition nutritionnelle des produits, la faisabilité du calcul de l'algorithme utilisé pour SENS en vue d'un déploiement sur le marché alimentaire français;
- d'analyser, au plan statistique, la distribution des aliments au sein des 4 classes proposées par SENS, entre les différents groupes d'aliments et au sein de chacun d'eux.

Sur la base des analyses précédentes, l'appui scientifique et technique devra comparer pour chaque groupe et famille d'aliments et au sein des diverses familles d'aliments, la distribution obtenue par application des 4 classes définies par l'algorithme SENS et des 5 classes définies pour le score de Rayner (telles que proposées après l'appui scientifique et technique de l'ANSES de mars 2015 et l'avis du HCSP d'août 2015).

Nous vous demandons de bien vouloir apporter une réponse à cette première demande, au plus tard en février 2016, en vous appuyant sur le document (algorithme) élaboré par le groupe d'experts mis en place par la FCD et les données produites en lien avec cet algorithme qui vous seront transmises dans les meilleurs délais.

Dans un second temps, votre évaluation portera sur l'analyse comparative de la pertinence en matière de nutrition des deux systèmes d'information étudiés au regard des enjeux de santé publique. Ce travail est attendu pour l'été 2016.

Le directeur général de la santé

Benoît VALLET

Le directeur général de l'alimentation

Patrick DEHAUMONT

Pour la directrice générale de la concurrence, de la consommation et de la répression des fraudes et par délégation,
Le sous-directeur des produits alimentaires et des marchés agricoles et alimentaires

Jean-Louis GERARD

[1] Agence Française de Sécurité Sanitaire des Aliments (AFSSA). Définition de profils nutritionnels pour l'accès aux allégations nutritionnelles et de santé: propositions et arguments. Juin 2008. https://www.anses.fr/fr/system/files/NUT-Ra-Profils.pdf

[2] Agence nationale de sécurité sanitaire des aliments de l'environnement et du travail Évaluation de la faisabilité du calcul d'un score nutritionnel tel qu'élaboré par Rayner et al. Mars 2015. https://www.anses.fr/fr/system/files/DER2014sa0099Ra.pdf

COURRIER ARRIVE
25 JUIL. 2016
DIRECTION GENERALE

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MINISTERE DES AFFAIRES SOCIALES ET DE LA SANTE

Direction générale de la santé
n° 182

MINISTERE DE L'AGRICULTURE, DE L'AGROALIMENTAIRE ET DE LA FORET

Direction générale de l'alimentation

MINISTERE DE L'ÉCONOMIE, DE L'INDUSTRIE ET DU NUMERIQUE

Direction générale de la concurrence, de la consommation et de la répression des fraudes

Paris, le 8 - JUIL. 2016

Le Directeur général de la santé

Le Directeur général de l'alimentation

La Directrice générale de la concurrence, de la consommation et de la répression des fraudes

A

Monsieur le Directeur général de l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail

Objet : Saisine relative à l'algorithme de classification nutritionnelle des aliments mis en place par les magasins Leclerc pour leurs magasins en « drive ».

La loi de modernisation de notre système de santé prévoit, dans son article 14-II et sous réserve des exigences prévues à l'article 35 du règlement européen (UE) n°1169/2011 du 25 octobre 2011 concernant l'information des consommateurs sur les denrées alimentaires (INCO), que les formes d'expression et de présentation fixées par INCO pour la déclaration nutritionnelle obligatoire puissent être complétées, sur un mode volontaire, par une forme d'expression ou de présentation exprimée sous d'autres formes et/ou présentée au moyen de graphiques ou symboles en complément des mots ou chiffres.

Vous avez rendu en mars 2015, puis en mars 2016 suite à des saisines des administrations deux rapports d'appui scientifique et technique relatifs à la faisabilité et à la comparaison des systèmes dits 5C et SENS. Il est prévu que l'Anses complète ces travaux par une analyse de la « pertinence nutritionnelle » de ces systèmes synthétiques qui permettent de « marquer » des aliments et non pas des régimes alimentaires.

En mai 2016, l'enseigne Leclerc a mis en place pour ses magasins « drive » et sur les produits aux marques Leclerc un étiquetage semblable au système « Health Star Rating » (HSR) développé et mis en œuvre en Australie et Nouvelle-Zélande. Les éléments du calcul sont disponibles sur http://healthstarrating.gov.au/internet/healthstarrating/publishing.nsf/Content/guide-for-industry-document.

Il est demandé à l'ANSES d'inclure le « Health Star Rating » dans ses travaux en cours, attendus pour l'automne 2016, sur la pertinence nutritionnelle des divers systèmes synthétiques d'étiquetage nutritionnels. L'agence tiendra les demandeurs informés des autres systèmes d'information qui retiendraient l'attention de ses experts.

Le directeur général de la santé	Le directeur général de l'alimentation	La directrice générale de la concurrence, de la consommation et de la répression des fraudes
Benoît VALLET	Patrick DEHAUMONT	Nathalie HOMOBONO

ANNEX 2

Presentation of the participants

PREAMBLE: The expert members of the Expert Committees and Working Groups or designated rapporteurs are all appointed in a personal capacity, *intuitu personae*, and do not represent their parent organisation.

RAPPORTEURS

Mr Olivier BRUYERE – University Professor (University of Liège) – epidemiology, public health

Mr Stephan MARETTE – Research Director (AgroParistech) – experimental economics, agri-food economics, food safety

Mr Thomas MOYON – Research Engineer (INRA Nantes) – biostatistics

Ms Lydiane NABEC – Lecturer (Paris-Sud University) – management sciences, consumer information, communication

Mr Stéphane WALRAND – Research Director (INRA Clermont-Ferrand/Theix) – pathophysiology

EXPERT COMMITTEE ON HUMAN NUTRITION

Chairman

Mr François MARIOTTI - Professor (AgroParisTech) - Specialities: metabolism of proteins, amino acids, intakes, nutritional requirements and recommendations, postprandial metabolism, cardiometabolic risk

Members

Ms Catherine ATLAN – Doctor (Luxembourg Hospital Centre) – Specialities: endocrinology, metabolic diseases

Ms Catherine BENNETAU-PELISSERO – Professor (Bordeaux Sciences Agro) – Specialities: phyto-oestrogens, isoflavones, endocrine disruptors, bone health

Ms Marie-Christine BOUTRON-RUAULT – Research Director (CESP Inserm) – Specialities: nutritional epidemiology and cancer, digestive system

Mr Jean-Louis BRESSON – University Professor – Hospital Practitioner (AP-HP Necker Hospital – Sick Children, Centre for Clinical Investigation 0901) – Specialities: epidemiology, immunology, infant nutrition, pregnant women and proteins

Mr Olivier BRUYERE – University Professor (University of Liège) – Specialities: epidemiology, public health, osteoporosis

Ms Blandine DE LAUZON-GUILLAIN – Research Manager (Inserm, CRESS, Villejuif) – Specialities: epidemiology, infant nutrition, nutrition of pregnant and breastfeeding women, public health

Ms Anne GALINIER – University Lecturer – Hospital Practitioner (Paul Sabatier University – Toulouse University Hospital) – Specialities: metabolism of adipose tissue/obesity, pathophysiology

Mr Jean-François HUNEAU – Professor (AgroParisTech) – Speciality: human nutrition

Ms Emmanuelle KESSE-GUYOT – Research Director (INRA, UMR Inserm U1153 / INRA U1125 / CNAM / University of Paris 13) – Specialities: epidemiology, nutrition and pathologies, nutrition and public health

Ms Corinne MALPUECH-BRUGERE – University Lecturer (University of Auvergne) – Speciality: nutrition of pathologies, metabolism of macro- and micronutrients

Ms Catherine MICHEL – Research Manager (INRA, UMR INRA / Hôtel Dieu University Hospital, Nantes) - Specialities: infant nutrition, intestinal microbiota, colic fermentation, prebiotics

Ms Béatrice MORIO-LIONDORE – Research Director (INRA Lyon) – Specialities: human nutrition, energy metabolism

Ms Jara PEREZ-JIMENEZ – Contract Researcher (ICTAN – CSIC, Madrid) - Specialities: micro-constituents, nutrition and pathologies, bioavailability

Mr Sergio POLAKOFF – Research Manager (INRA Clermont-Ferrand/Theix) – Specialities: nutrition and pathologies, nutrition and public health, energy metabolism

Mr Jean-Marie RENAUDIN – Hospital Practitioner (Emilie Durkheim Hospital Centre) – Specialities: allergology

Ms Anne-Sophie ROUSSEAU – University Lecturer (University of Nice Sophia Antipolis) - Specialities: nutrition and physical activity, bioavailability, oxidative stress

Mr Luc TAPPY – University Professor – Hospital Practitioner (University of Lausanne) – Specialities: endocrinology, metabolism of carbohydrates

Mr Stéphane WALRAND – Research Director (INRA Clermont-Ferrand/Theix) – Specialities: pathophysiology, protein metabolism and amino acids

ANSES PARTICIPATION

Scientific coordination of the project was provided by the Nutritional Risk Assessment Unit of the Risk Assessment Department (DER), under the direction of Ms Irene MARGARITIS – Seconded University Professor (University of Nice Sophia Antipolis).

Scientific coordination

Ms Sabine HOUDART – Nutritional Risk Assessment Unit, DER – Scientific project manager

Scientific contribution

Mr Thomas BAYEUX – Risks and Society Unit, Department of Information, Communication and Dialogue with Society – Socio-economic analyst

Ms Eve FEINBLATT – Risks and Society Unit, Department of Information, Communication and Dialogue with Society – Socio-economic analyst

Administrative secretariat

Ms Virginie SADE – ANSES

HEARINGS WITH EXTERNAL EXPERTS

SENS (hearing of 29 June 2016)

Ms Nicole Darmon, INRA UMR NORT

Mr Matthieu Maillot, MS Nutrition

Ms Emilie Tafournel, FCD

5C (hearing of 30 June 2016)

Ms Chantal Julia, Centre of Research in Epidemiology and Biostatistics, Sorbonne Paris Cité

HSR (hearing of 23 August 2016)

Mr Stephan Arino, ACDLec-LECLERC

Mr Rémi Girouille, Scamark

Mr Luc Horemans, Scamark

ANNEX 2: DEFINITIONS OF DIETARY REFERENCE VALUES

Average Requirement (AR): average daily need within the population, as estimated from individual intake data in relation to a criterion of nutritional adequacy in experimental studies.

Population Reference Intake (PRI): daily intake that covers the requirement of almost the entire population considered, as estimated from experimental data. The PRI is calculated from an estimate of the parameters of distribution of the requirement. Most often the PRI is estimated from the AR, to which are added two standard deviations, in order to determine the intake that covers the requirement of 97.5% of the population. As the standard deviation is most often estimated at 15% of the AR, the PRI is therefore 1.3 times the AR. There is a consensus on this definition around the world. It corresponds to that of the previously used French term "*apport nutritionnel conseillé*" (ANC), which was also used by extension for different types of dietary reference values. In the interests of clarity, the term ANC has been abandoned in favour of PRI and two new types of dietary reference values: the adequate intake and the reference intake range.

Adequate Intake (AI): average daily intake of a population or sub-group whose nutritional status is considered adequate.
The French AI is the dietary reference value selected:

- when the AR and therefore the PRI cannot be estimated due to the lack of sufficient data, and corresponds to the EFSA definition of "Adequate Intake (AI)";
- or when the value of the PRI can be estimated but is not considered satisfactory in view of long-term observations of the population establishing that this PRI cannot meet health criteria that would be more appropriate than the criteria used to estimate the AR. Thus, unlike the EFSA AI, the French AI is not solely intended as a substitute for the PRI in the case where the latter cannot be calculated. This definition also takes into account the fact that there are more and more data concerning the relationships between intake and modulation of the risk of disease in the long term.

Reference Intake Range (RI): range of intakes considered adequate for maintaining the population in good health. It is a dietary reference value specific to energy macronutrients, expressed as a percentage of total energy intake.