Amundi
ASSET MANAGEMENT
RESEARCH STRATEGY & ANALYSIS

Discussion Paper

DP-26-2017

October 2017

THE FOOD CHALLENGE: HOW CAN ONE ACHIEVE GREATER TRANSPARENCY?

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Finalised at 31 August 2017

For professional investors only

Summary

What do we really eat? What information do labels give us? Do they tell us everything? Are companies really being transparent?

We felt it would be useful to address these issues at a time when we see three important trends emerging in the market:

1. The gradual implementation of stringent regulations, such as the EU's INCO (Information to Consumers) regulation: The regulation introduces mandatory nutrition declarations applying from 13 December 2016, in the form of a table placed on product packages and specifying the energy value and the quantities of fat, saturated fatty acids, carbohydrates, sugar, protein and salt. Another example is the new "Nutrition Facts" label made mandatory in the United States from 2018. In both cases, the logic is the same: to inform consumers and enable them to compare products;
2. A change in consumer behaviour: Consumers have become more demanding in terms of quality and transparency, as evidenced notably by the multiplication of labels offering a more restrictive framework than the regulatory framework on the use of additives, pesticides, or GMOs;
3. Warnings from scientists and NGOs about the hazardous nature of some products or practices: For example, studies showing a link between some sweeteners and hyperactivity in children, which led to a warning being put on labels in Europe but not in the United States. Conversely, other studies, notably those on aspartame, did not lead to any restrictions by the health authorities, whether in Europe or the United States.

How do companies integrate these changes? Are these risks and/or opportunities? This study aims to address these questions by:

- deciphering the information on the packaging,
- providing a preliminary clarification on the regulatory context and health risks.

For this purpose, we contacted 17 companies in five countries and five sectors – including three subsectors of the agri-food industry, mass retail and catering – in order to get a comprehensive picture from field to fork. We interviewed them on

six issues: nutrition, responsible marketing, additives, contaminants (pesticide residues, drug residues, pollutants and residues of materials in contact with food), nanoparticles and GMOs.

Our first conclusion concerns the maturity of companies by sector.

Companies in the retail sector obtain the best results. Some retailers integrate the precautionary principle, when others are too often content with complying with local regulations. This peculiarity is explained by the fact that the retail sector is the one most sensitive to the reputational risk.

Our second conclusion concerns the degree to which companies handle each of the six issues addressed.

Nutrition is by far the criterion best managed by companies. They generally have a policy on the use of sugar, fat and salt, with quantified or at least qualitative objectives.

The second criterion for which the most information is available is responsible marketing, especially since claims are highly regulated.

On the subject of pesticides, nanoparticles, antibiotics and GMOs, companies usually merely comply with local regulations, with no proactivity or global policy. Nanoparticles are the most taboo subject.

Our recommendations therefore relate to the implementation of a transparency and precautionary policy that goes beyond local regulations.

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Introduction

With the prevalence of obesity having doubled since 1980 around the world (40% of adults are overweight and 13% are obese) and most of the world's population living in countries where overweight and obesity-related health issues are causing more deaths than insufficient weight, the content and the nature of our diet are paramount for nutritional purposes[1]. Food manufacturers are regularly singled out for some of their practices: controversial additives, endocrine disruptors, horse meat scandal, nanomaterials, drug or pesticide residues, contamination due to packaging, abusive claims, etc. In some quarters, they are accused of endangering public health, but others see them as the guarantors of progress to improve marketed food products. In a regulatory context that is becoming more stringent in parallel with food scandals, and in an environment where consumers' requirements and expectations are increasingly pressing, industrial groups are expected to be able to adapt in compliance with regulations and their clients' demands. This is the backdrop to this thematic study, which aims to decipher some of the information on food packaging and to analyse the behaviour of a sample of companies in the agri-food, retail and catering sectors. The objective of this study is to better understand the issues surrounding the responsibility of food products and to analyse the nature of the information disclosed by companies.

We will therefore start by developing some elements relating to labelling in the first chapter, and, then, examine the nutritional information in the second. Substances potentially at risk are discussed in the third part of this study. Finally, drawing on the information disclosed by companies, interviews with groups and reports or information from various stakeholders, we will present the results of the assessment of the performance of companies in our sample on these issues, focusing on four major themes displayed on food packaging, namely: nutritional issues, additives and claims, chemical residues and a few special cases such as palm oil, nanomaterials and GMOs.

[1] *http://www.who.int/mediacentre/factsheets/fs311/en/*

I. Food labelling

For this thematic study, we started from conventional food packaging and listed and analysed some of the information disclosed to the consumers on the pack.

Food labelling must be present on food products to better inform consumers. Labelling requirements differ according to how the food is packed or presented (prepacked or not)[2].

1.1. Regulatory context

1.1.1. Europe

In 2011, following an intensive billion-euro lobbying campaign, the agri-food industry overturned the European Union's project to introduce clear, mandatory labelling[3].

However, the nutrition declaration has been applicable in Europe on a voluntary basis since 2011. Since 13 December 2016, the application of the INCO regulation, which seeks to help consumers make well-informed choices about the food they consume, has been mandatory for prepacked food. An easy-to-read table is required to be displayed on the pack, enabling the consumer to identify the product's energy value and the quantities of fat, saturated fatty acids, carbohydrates, sugars, protein and salt. This text also requires the disclosure of the country/region of origin for the following foods: meat, honey, olive oil, fresh fruit and vegetables. In addition, since 13 December 2014, allergenic substances must be shown clearly in the list of ingredients.

Labels must show 12 mandatory particulars[4]:

- The name of the food
- The list of ingredients
- Any ingredient causing allergies or intolerances
- The quantity of certain ingredients or categories of ingredients
- The net quantity of the food
- The date of minimum durability or the 'use by' date
- Any special storage conditions and/or conditions of use
- The name or business name and address of the food business operator established in the European Union or the importer into the Union market
- The country of origin or place of provenance

[2] *https://www.economie.gouv.fr/files/files/directions_services/dgccrf/documentation/fiches_pratiques/fiches/etiquetage-denrees-alimentaires.pdf*

[3] *http://www.lemonde.fr/les-decodeurs/article/2016/07/08/explorez-les-conflits-d-interets-autour-de-l-etiquetage-alimentaire_4966229_4355770.html*

[4] *http://www.capinov.fr/etiquetage-des-aliments-reglement-1169-2011-inco.php*

- Instructions for use where it would be difficult to make appropriate use of the food in the absence of such instructions
- With respect to beverages containing more than 1.2% of alcohol by volume, the actual alcoholic strength by volume
- A nutrition declaration

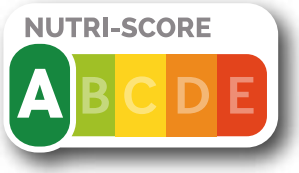
Other information is mandatory, for instance, the designation "defrosted" in the case of foods that have been frozen before sale and which are sold defrosted, or "irradiated" for foods and food ingredients treated with ionising radiation, the country of origin or place of provenance for meats, etc.

For the moment, alcoholic beverages are not concerned. Although a few companies do set a good example. For instance, a French spirits company has decided to display nutritional information for its flagship brands[5].

Since 2013, major producers of beer, wine and spirits, grouped together within the International Alliance for Responsible Drinking (IARD), have engaged in a programme of 5 commitments for responsible consumption that includes better information to consumers. Furthermore, on 13 March 2017, the European Commission invited the alcoholic beverage industry to "develop a self-regulatory proposal that provides information on ingredients and nutrition on all alcoholic beverages "[6].

1.1.2. The case of France

In 2014, the French National Institute of Health and Medical Research (INSERM) worked on a five-colour logo system: the Nutri-score. Products are labelled in one of five colours ranging from green to red depending on various parameters such as: content in fruit and vegetables, fibre, protein or saturated fatty acids.



Source: Ministry of Health

The agri-food industry was not in favour of this labelling system. In 2015, the French Ministry of Health abandoned its public project and asked the Directorate-General for Health to conduct a study comparing four different systems:

- The Nutri-score developed by INSERM
- The UK traffic light labelling system
- The SENS system
- The Nutri Repère system

On 15 March 2017, the Nutri-score was finally adopted in France as a new labelling system on a voluntary basis from April 2017. EU rules do not provide

[5] *https://www.pernod-ricard.com/fr/medias/communiques-de-presse/pernod-ricard-met-en-avant-linformation-nutritionnelle-de-toutes-ses/*

[6] *http://europa.eu/rapid/press-release_IP-17-551_fr.htm*

for making this logo compulsory. It covers processed products and products in the fresh prepared food section. On the other hand, local products are not concerned.

The Nutri-score is calculated based on research by Oxford researchers. Each food is assigned negative points depending on its content in fat, salt, sugar, and energy. This score is then adjusted with positive points for protein and fibre content[7]. Note that the Nutri-score does not take into account additives, antibiotic residues or GMOs.

The calculation of the points awarded to each of the nutrients of the so-called "negative" component follows the methodology developed by Rayner et al.

Points	Energy value (kJ/100g)	Of which saturated fatty acids (g/100g)	Sugar (g/100g)	Sodium (mg/100g)
0	≤335	≤1	≤4,5	≤90
1	> 335	> 1	> 4,5	> 90
2	> 670	> 2	> 9	> 180
3	> 1005	> 3	> 13,5	> 270
4	> 1340	> 4	> 18	> 360
5	> 1675	> 5	> 22,5	> 450
6	> 2010	> 6	> 27	> 540
7	> 2345	> 7	> 31	> 630
8	> 2680	> 8	> 36	> 720
9	> 3015	> 9	> 40	> 810
10	> 3350	> 10	> 45	> 900

Source: Anses 2015[8]

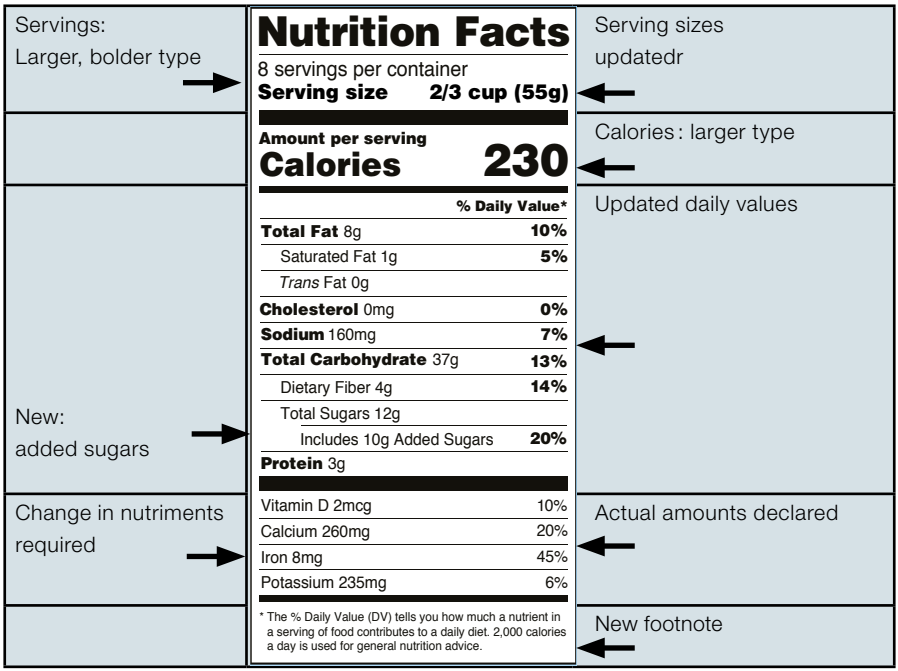
1.1.3. The case of the United States

In May 2016, the FDA announced the new Nutrition Facts label for packaged foods to reflect new scientific information, including the link between diet and chronic diseases such as obesity and heart disease. The new label will be used from July 2018. The main changes include increasing the type size for "Calories" and the "Serving size" declaration.

[7] *http://www.huffingtonpost.fr/2017/03/15/nutri-score-comment-marche-la-recette-doxford-pour-classer-un_a_21893991/*

[8] *https ://www.anses.fr/fr/system/files/DER2014sa0099Ra.pdf*

What's different on the new label? (source: FDA[9])



Source: FDA 2017

1.1.4. The case of Canada

Regulated disclosures for the majority of packaged foods in Canada[10] focus on:

- A nutritional table mentioning several elements: serving size, calories, % of daily value and information on the following 13 key nutrients:
  - Fat
  - Saturated and trans fat
  - Cholesterol
  - Salt
  - Carbohydrate
  - Fibre
  - Sugar
  - Protein

[9] *https://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/labelingnutrition/ucm385663.htm*

[10] *https://www.canada.ca/en/health-canada/services/food-nutrition/food-labelling/nutrition-labelling.html*

– Vitamin A
– Vitamin C
– Calcium
– Iron

Note that restaurants and catering companies are not required to provide nutritional tables for their products.

List of ingredients

Nutritional claims

Furthermore, in 2017, the Canadian government decided to implement improvements in the nutrition facts table and the list of ingredients that appear on food packages or labels. Companies have five years to comply. The purpose of these amendments is to make labels clearer and better adapted to the nutritional needs of Canadians (for example, adding potassium because it plays an important role in maintaining cardiovascular health), making serving sizes more consistent and comparable, etc[11].

1.2. Misleading labels

Despite a binding regulatory framework, agribusinesses are regularly accused of deceiving consumers by using marketing techniques to 'flatter' the product and sell more[12]. The NGO Foodwatch regularly attacks the sector for adopting misleading labelling practices to make products more appealing, and calls for more honesty.

The NGO's 15-point plan against misleading labelling and advertising includes disclosure on: realistic illustrations, binding information on the quantities of ingredients promoted, comprehensive product origin, unambiguous nutritional information, transparency on manufacturing, ban on marketing products intended for children that are nutritionally unbalanced, etc.[13].

1.3. Labels

Several labels, put forward in the following table, offer a more restrictive framework regarding the presence or not of GMOs as well as limits for antibiotic and pesticide residues.

[11] *https://www.canada.ca/fr/sante-canada/services/modifications-etiquetage-aliments.html?_ga=2.143451957.1022740083.1502440187-1711328192.1502440187*

[12] *http://www.foodwatch.org/fr/s-informer/topics/arnaque-sur-l-etiquette/l-info-en-2-minutes/*

[13] *http://www.foodwatch.org/fr/s-informer/topics/arnaque-sur-l-etiquette/en-savoir-plus/etiquetage-15-revendications/*

Labels	Use of synthetic chemicals	GMO free	Processes that can introduce pollution	% of ingredients from organic farming	Self-sufficiency in organic products	Limits for antibiotics, additives, processing aids
Agriculture Biologique (Organic farming)	No	Yes	Banned	0.95		
Bio Cohérence (Organic Coherence)	No	Yes	Banned	1		
Bio équitable (fair trade)	No	Yes	Banned	0.95		
Bio Solidaire (fair trade)	No	Yes	Banned	0.95		
Biodyvin	Limited			1		
Demeter Agriculture biodynamique	No	Yes	Banned	1	Yes	
Ecocert ESR	No	Yes	Banned	0.95		
Euro-feuille	No	Yes	Banned		Yes	Yes
Forest Garden product	No	Yes				Yes
Nature et progrès (Nature and progress)	No	Yes	Banned	0.95		

Source : Amundi 2017

II. A digest on nutrition

2.1. Nutrition declaration

Source: Recherche Amundi

The nutrition declaration, which became mandatory on 13 December 2016 for prepacked products, is intended to "help consumers to compare products and make well-informed choices for their health"[14]. It therefore applies to most foods (with the exception of mineral water and food supplements).

This is an important development as nutrition labelling was not mandatory previously, except if the food made nutrition or health claims or had added vitamins, minerals, or other substances.

The nutrition declaration should preferably be in table format.

The main mandatory particulars to be included in a nutrition declaration are presented in the following table[15] [16]:

[14] *https://www.economie.gouv.fr/dgccrf/Publications/Vie-pratique/Fiches-pratiques/declaration-nutritionnelle-sur-denrees-alimentaires*

[15] *Ibid*

[16] *http://vosquestions.mondelezinternational.fr/quelleportion/comprendre-linformation-nutritionnelle/*

In **bold**, the mandatory particulars of the EU INCO regulation	Per 100 g or 100 ml	Reference intake of an average adult	Functions and examples
Energy value	kJ/kcal	8400kJ (2000kcal)	Fuel needed by the body to function efficiently. It is provided by various nutrients: fat, protein, carbohydrate and fibre
Fat of which:	g	70g	Mixture of saturated and unsaturated fatty acids essential for the body, for the proper functioning of the brain and the energy supplied
• **Saturated fatty acids**	g	20g	
• Monounsaturated fatty acids	g		
• Polyunsaturated fatty acids	g		
Carbohydrate of which:	g	260g	Main source of energy. Several types, from: - starches, which provide energy absorbed slowly by the body - sugar, which provides fast energy to the body
• **Sugars**	g	90g	
• Polyols	g		
• Starch	g		
Dietary fibre	g		Important for intestinal transit: fruit, vegetables, whole grains
Protein	g	50g	Two types, animal and plant; central role in vital bodily functions, notably growing strong bones and muscles. Meat, eggs, fish, pulses.
Salt	g	6g	Composed of sodium and chloride, it is used as a flavour enhancer and helps preservation
Vitamins and mineral salts	% of reference intake		

Sources: DGCCRF, Mondelez

The nutrition declaration may also include one or more of the following elements, on an optional basis: monounsaturated fatty acids, polyunsaturated fatty acids, polyols, starch, dietary fibre and vitamins as well as minerals present in significant amounts.

2.2. Claims

2.2.1. Definition

According to EFSA[17], a "nutrition claim states or suggests that a food has beneficial nutritional properties". Examples include "high vitamin C content", "low fat" or "no added sugar".

A "health claim" is any statement on labels, advertising or other marketing products that health benefits can result from consuming a given food. In other words, there is a link between a specific food and improved health, or consuming a food and reducing the risk of developing a particular disease.

2.2.2. Examples of regulatory frameworks

In Europe

In 2006, the European Union adopted a regulation on the use of nutrition and health claims on foodstuffs (Regulation 1924/2006), which came into force in July 2007. The permitted claims are listed in the annexes to this regulation. The rules are therefore harmonised at European level for the use of claims and are based on nutrient profiles. These profiles define the overall nutritional requirements to be met by products in order to make specific health and nutrition claims[18]. Since the entry into force of this regulation, the European Food Safety Authority (EFSA) has been in charge of evaluating claims prior to foods being put on the market, while the European Commission is responsible for holding the register of permitted claims[19].

The regulation therefore seeks to propose a framework for health and nutrition claims and to ensure that consumers are not misled by the claims made, as part of the EU's commitment to promoting healthier lifestyles and protecting consumers.

This regulation also aims to establish clear, harmonised rules for food producers and manufacturers and to encourage innovative companies in terms of health claims. These rules do not cover cosmetics, drugs, or pet food and animal feed.

[17] *https://www.efsa.europa.eu/en/topics/topic/nutrition-and-health-claims*

[18] *Ibid*

[19] *https://www.anses.fr/en/content/claims*

Examples of nutrition claims	
Low energy value	less than 40 kcal per 100g (20 kcal per 100ml for liquid foods)
Low sugar content	less than 5g per 100g (2.5g per 100ml)
Low in sodium	less than 0.12g of sodium for 100g or 100ml
Source of dietary fibre	at least 3g of fibre per 100g or 1.5g per 100 kcal
Rich in dietary fibre	at least 6g of fibre per 100g or 3g per 100 kcal
Source of vitamin or mineral	at least 15% of the RDA* in this vitamin or mineral
Rich in vitamin or mineral	at least 30%
* RDA: Recommended Daily Intake	

Source: Danone[20]

Nutritional profile:

Products that make nutrition claims must have a "favourable nutritional profile" to help consumers avoid choosing food ill-adapted to a good nutritional balance. For example, a product enriched in calcium and vitamins cannot make use of these claims if it is very rich in sugar and saturated fat.

In Canada[21]**:**

A distinction is made between:

- disease risk reduction claims: "A healthy diet with a variety of vegetables and fruit to help reduce the risk of certain types of cancer"
- function claims, e.g. "Consuming 7 grams of fibre from coarse wheat bran promotes regularity"[22]

Health claims are optional. However, when they are used, they must be truthful and non-misleading. In other words, manufacturers and importers must be able to present scientific evidence before using such claims.

[20] *http://institutdanone.org/objectif-nutrition/92-la-nouvelle-reglementation-des-allegations-nutritionnelles-et-de-sante/dossier-la-nouvelle-reglementation-des-allegations-nutritionnelles-et-de-sante/*

[21] *https://www.canada.ca/en/health-canada/services/food-nutrition/food-labelling/health-claims.html*

[22] *http://www.extenso.org/article/favorisez-votre-regularite/*

In the United States:

Among claims that can be used on products sold in the United States, there are three categories defined by law or in FDA regulations[23]: health claims, nutrition claims and claims on the structure or function.

2.3. Problems related to claims[24]

In the past, food manufacturers made substantial profits on selling products claiming to improve health. Although regulations have become far stricter since 2007, notably in Europe, manufacturers still sometimes make an abusive use of misleading claims for marketing purposes. For instance, some elements of our diet have received a lot of bad press, notably fat and sugar. Manufacturers can therefore be tempted to state the absence of these elements on the packaging. But when the product concerned does not contain any fat or sugar naturally, this type of claim is misleading, suggesting that the product is a more attractive health alternative than other rival products.

Other abuses can be highlighted, notably erroneous product comparisons, e.g. "50% less [of a given nutrient]", but this is in comparison with the brand's original product brand and not with that of another brand. Claims for marketing purposes can also be made on "health ingredients", which are actually present only in small proportions that do not necessarily justify their being highlighted on the label. Other claims may also be confusing. For example: a "low fat" food can actually be richer in sugar to enable the end product to be more similar in taste and texture to the original version.

In addition to nutritional aspects, marketed foods and products may contain additives, nanotechnology or residue of pesticides or other chemicals. Their presence is not always disclosed on labels.

[23] *https://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm111447.htm*

[24] *http://www.extenso.org/article/ces-allegations-qui-portent-a-confusion/*

III. Potentially risky ingredients

3.1. Additives

3.1.1. Definitions

According to ANSES[25], the French governmental agency dealing with sanitary safety26, "a food additive is a substance that is not normally consumed as food or used as an ingredient in food.

These compounds are added to food for a technological purpose at the stage of manufacturing, processing, preparation, treatment, packaging, transport or storage of food and are therefore found in the composition of the end product".

Food additives are generally classified by function:

Objectives	Types	Functions	Examples
Ensure sanitary quality of food	Preservatives	Extend a product's life	Carbon dioxide (E290) Parabens (E216 and E217)
	Antioxidants	Prevent product oxidation	Vitamine E (E307)
Improve appearance and taste	Colouring agents	Give colour to foods	Chlorophyll (E140) Caramel colouring (E150c)
	Sweeteners	Give food a sweet taste	Sorbitol (E420) Aspartame (E951)
	Flavour enhancers	Increase perception of taste	Glycine (E640).
Confer a specific texture	Thickening/Gelling agents	Make liquid foods less runny	Xanthan gum (E415)
Guarantee product stability	Emulsifying/ Stabilising agents	Stabilise an emulsion and prevent the two phases from separating	Cellulose (E460)
	Anti-caking agents	Prevent powders from caking	Sodium carbonate (E500)

Source: Amundi 2017

While the use of additives dates back to ancient times, for example, sea salt to preserve meat and fish, or saltpetre used by the Romans to preserve food and improve its appearance, it was the advent of the agri-food industry in the 1950s-60s, and more particularly that of ready-made dishes and soda, that drove a considerable increase in their use.

The main reasons were: population increase, higher living standards, and urbanisation, which drove a wedge between the producer and the consumer.

[25] *https://www.anses.fr/en/content/focus-food-additives*

We can distinguish five stages of development[26]:

1. From 1945 to 1950, the primary need was to feed populations after a war during which restrictions, or even famine, were widespread. It was therefore necessary to produce. This was the period of "more quantity".
2. Then came the 1960s, when higher living standards drove consumer demand for "greater variety" in their choice of food.
3. After variety, the search for "quality" characterised the 1960s-70s and is still continuing.
4. Finally, since the 1980s, "more security" seems to have become the watchword of the agri-food industry.
5. We can predict that the trend in the next decades will be the quest for "more well-being", "better health".

In 2010, Leatherhead Food Research[27] estimated global sales of food additives at nearly $24.5 billion, with a forecast growth rate of 2.5% per year[28]. Because of this change (quantitative and qualitative), additives themselves have changed, as well as how they are produced; originally natural, they are increasingly obtained by the chemical modification of a natural or synthetic extract.

Origins		Production method	Examples
Natural		Extracts from plant or animal substances existing in nature	Curcumin (E100), yellow-orange colour, extracted from roots of Curcuma longa
Modification of natural products		Obtained by chemical modification of a natural extract of a plant or animal substance to improve its properties	Emulsifiers produced from vegetable oils, sweeteners derived from fruits and organic acids derived from edible oils
Synthetic	Identical to natural	Reconstituted by chemical synthesis as a substitute for natural food additives	Ascorbic acid (vitamin C)
	Artificial	They have no equivalent in nature. They are completely artificial, obtained by chemical synthesis	Saccharin

Source: Amundi 2017

[26] *http://alimentation-sante.org/wp-content/uploads/2011/07/dossier-scient-10.pdf*

[27] *Founded in 1919, Leatherhead Food Research, based in London, is an independent organisation providing research, scientific and regulatory advice.*

[28] *http://www.lelanceur.fr/additifs-alimentaires-ce-que-nous-mangeons-vraiment/*

This last group of additives, artificial, synthetic additives, is the most controversial one in terms of consumer health.

3.1.2. Regulatory context

International

The international standard for food additives is the Codex Alimentarius published by the World Health Organization and the Food and Agriculture Organization of the United Nations; it is the reference text on additives and draws on[29]:

- the Joint FAO/WHO Expert Committee on Food Additives (JECFA), founded in 1956, which evaluates the safety of food additives, contaminants and naturally occurring toxicants, while establishing Acceptable Daily Intakes (ADIs). EFSA defines the acceptable daily intake as "an estimate of the amount of a substance in food or drinking water that can be consumed over a lifetime without presenting an appreciable risk to health"[30] (cf. section 3.2.5 for more details),
- the Codex Committee on Food Additives and Contaminants (CCFAC), founded in 1964, which examines for each food the technological merits of an additive and its dosage.

This standard is not binding and merely sets a framework that can be adopted, or not, by national regulations. Some additives are authorised in a number of countries but banned elsewhere. These include:

Category	Additives	Countries where authorised	Countries with bans or restrictions (limits or labelling)
Colouring agents	Red 3	United States	Europe (with label: "*May have an adverse effect on activity and attention in children" ct on activity and attention in children* »
	Yellow 5 (Tartrazine) E102		
	Yellow 6		
Preservatives	BHA (E320)	United States Europe	Japan UK (in infant food)
	BHT (E321)	United States Europe	Australia, Japan, Romania, Sweden, United Kingdom (in infant food)
Other	Potassium bromate (E924)	United States	Europe Argentina, Brazil, Canada, China, India, Nigeria, South Korea, Peru
	Trans fats/ PHO	United States Europe	Denmark, Austria, Hungary, Iceland, Norway and Switzerland (limits)

Source: list based on the list of controversial additives in Société Générale's "True colors" study of 2 June 2015, updated in May 2017

[29] *http://alimentation-sante.org/wp-content/uploads/2011/07/dossier-scient-10.pdf*

[30] *https://www.efsa.europa.eu/fr/press/news/080314*

In Europe[31]

The evaluation and approval of food additives are framed and harmonised at European level by EU regulations EC 1331/2008 and EC 1333/2008.

Additives are first evaluated by EFSA (the European Food Safety Authority). On this basis, the Commission then establishes a list of authorised additives and indicates the foods in which they may be added and the maximum doses to be used.

Several principles guide the authorisation of additives:

1. The list drawn up by the commission is a positive list of additives, that is to say that only additives that are present on this list can be added in food items.
2. An additive is allowed in human food only if there is no risk to the consumer due to the doses used.
3. An additive must also demonstrate its value. It is approved only if the following two conditions are met:

– the claimed technological effect can be demonstrated,
– its use is not likely to mislead the consumer.

A European regulation of 2008 requires that the safety of all food additives authorised in the EU up to 20 January 2009 be subject to re-evaluation[32].

The deadline for the completion of this re-evaluation is 2020 (until then, the use of these additives is permitted).

In 2016, 41 food colours were re-evaluated:

– the maximum levels of three food colours (E104, E110, E124) were reduced,
– the 2G red colour (E128) was withdrawn from the market.

[The re-evaluation of aspartame was carried out early in 2013 and is the subject of a review below].

3.1.1. Opportunities

The responsible use of food additives in the food industry is the same as at household level. The objectives are the same, but on a large scale. Additives effectively limit health risks and improve the appearance of food.

Sanitary

Food products are at risk of developing microorganisms, with more or less serious consequences:

[31] *https://www.anses.fr/en/content/focus-food-additives*

[32] *http://www.efsa.europa.eu/en/topics/topic/food-additive-re-evaluations*

Type of bacteria	Health consequences
Less virulent bacteria	Alteration of product quality
Listeria, Escherichia coli, Salmonella, Staphylococcus	Serious intoxications
Botulinum toxin (which develops in meats)	Fatal intoxications

Source: Amundi and scientific dossier no.10 of the IFN (French Institute for Nutrition) 1998

The cold chain makes it possible to limit this risk, but it is not applicable to some products (destruction of structures of water-rich products, syneresis[33] after thawing).

In this case, additives make food safer.

Organoleptic

Additives are also useful to maintain or improve sensory properties (flavour, taste, colour, texture).

These two functions alone justify the presence of more than 20 additives on the market.

Consumer expectations	Value of additives
For the majority of consumers, colour is inseparable from the product. A mint syrup which is not green is not recognised as such and is therefore not consumed (even though the taste is identical).	The colour of a food frequently results from molecules that have low resistance to processing and/or preparation treatments. Colouring agents restore or embellish a food's colour at the end of the treatment.
The enjoyment sought by consumers when eating certain foods requires a creamy or smooth texture (e.g. in creams and mousses).	Emulsifiers and/or thickeners change a food's texture.

Source: Amundi and scientific dossier no.10 of the IFN (French Institute for Nutrition) 1998

Economic

Additives make it possible to reduce manufacturing costs for the food industry.

For example, in 2016, to produce a tonne of vanilla ice cream, it took 2 kg of vanilla pods (cost: €780) or 300g of vanillin (cost: €42) or 25g of synthetic ethylvanillin

[33] *In chemistry, syneresis refers to the extraction or expulsion of a liquid from a gel*

(€4)[34]. But while additives enabled the agri-food industry to meet the challenges of population growth, producing more while meeting consumers' requirements for diversity and low costs, their use poses new health risks.

3.1.4. Risks

Despite the authorisations obtained, some additives are suspected of being harmful to health.

As we have seen, before they can be used by manufacturers in food products, additives must be examined by the relevant bodies and meet rules of non-toxicity. Studies are mainly carried out by the manufacturers themselves, meaning there is a significant risk of bias (in the United States, two-thirds of studies are financed by manufacturers[35]). In addition, potential health problems appear only years after approval[36].

Thus, despite the authorisations, several studies conducted in the last ten years have found links between the consumption of food additives and various adverse reactions or diseases: hyperactivity in children, headaches, obesity, cholesterol, diabetes, cancer, etc.

Sweeteners and hyperactivity in children

The British Food Standards Agency commissioned a study on the effects of consuming beverages containing sweeteners (E100) in children. The study, published in The Lancet in 2007 and conducted by McCann et al. on 153 children aged 3 and 144 children aged 8 to 9, concludes that there is a link between the associations of certain food colours and the preservative sodium benzoate and hyperactivity in children (Source: EFSA[37]).

Emulsifiers and disruption of the intestinal microbiota

A Cancer Research publication in 2016 shows that exposing mice to two commonly-used emulsifiers (carboxymethyl cellulose, E466, and polysorbate-80, E433) disrupts their intestinal microbiota and increases the risk of colorectal cancer[38].

Emulsifiers apparently disrupt the protection mechanism of the inner surface of the intestine against bacterial attacks and generate various inflammatory reactions (Crohn's disease, colitis, etc.) and various metabolic syndromes (conjunction of obesity, high blood pressure, cholesterol, diabetes, etc.).

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[34] *http://www.lelanceur.fr/additifs-alimentaires-ce-que-nous-mangeons-vraiment/01/04/2016*

[35] *http:///journals.plos.org/plosone/article?id=10.1371/journal.pone.0175643*

[36] *https://www.lanutrition.fr/anne-laure-denans-sil-y-a-des-additifs-dans-un-produit-cest-un-faux-aliment*

[37] *https://www.efsa.europa.eu/en/press/news/080314*

[38] *Study "Dietary emulsifiers impact the mouse gut microbiota promoting colitis and metabolic syndrome". February 2015. Benoit Chassaing, Omry Koren, Julia K. Goodrich, Angela C. Poole, Shanti Srinivasan, Ruth E. Ley, Andrew T. Gewirtz*

Sweeteners and diabetes

According to a study by the Weizmann Institute in Israel, published in Nature in 2014, artificial sweeteners can lead to metabolic changes and contribute to increasing the risk of diabetes and obesity.

According to Dr. Eran Elinav, the study's results "*invite a review of the currently massive and uncontrolled consumption of these substances*"[39].

3.1.5. Debates and the emblematic case of aspartame

However, we observe that the health authorities do not always unanimously agree about the findings of these studies, as evidenced by the following examples.

EFSA concluded that the study by McCann et al on the links between sweeteners and hyperactivity in children brought only limited evidence of a slight effect on activity and attention in some children: "the group concluded that the results of the study by McCann et al. could not serve as a basis for a modification of the ADI of the respective food colours or sodium benzoate "[40].

In this respect, the case of aspartame is emblematic of the debate between scientists and health authorities. Despite several scientific studies that establish links between aspartame and health risks, aspartame was re-evaluated by EFSA, which confirmed its innocuousness.

Definition of aspartame

EFSA[41] defines aspartame as "*a low-calorie, intense artificial sweetener. It is a white, odourless powder, approximately 200 times sweeter than sugar. In Europe, it is authorised to be used as a food additive in foodstuffs such as drinks, desserts, sweets, dairy, chewing gums, energy-reducing and weight control products and as a table-top sweetener*".

Risks of aspartame for consumers

Studies show a link between aspartame and health risks[42]:

A study (led by the Danish researcher Thorhallur Halldórsson, from the Department of Epidemiology Research of the Statens Serum Institute, published at the end of 2010 in The American Journal of Clinical Nutrition) was conducted on 59,334 pregnant Danish women, establishing a link between diet soda consumption and the risk of premature birth.

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[39] *http://www.lexpress.fr/actualite/societe/sante/les-edulcorants-aggraveraient-le-risque-de-diabete-et-d- obesite_1577513.html*

[40] *https ://www.efsa.europa.eu/en/press/news/080314*

[41] *http://www.efsa.europa.eu/en/topics/topic/aspartame*

[42] *http://www.lemonde.fr/vous/article/2011/01/21/l-aspartame-pas-si-leger-pour-la-sante_1468744_3238.html*

Another study (led by Dr. Morando Soffritti, Ramazzini Institute, published in December 2010 in the American Journal of Industrial Medicine) shows the sweetener has a carcinogenic effect.

Position of EFSA and the European Union

In December 2013, EFSA nevertheless concluded that aspartame and its degradation products were safe for the general population (including infants, children, and pregnant women)[43].

The currently applicable acceptable daily intake (ADI) of 40 mg/kg of body weight per day is adequate protection for the general population. In addition to additives, contaminants are also risky products, but we are not talking here about a voluntary addition by the manufacturer, which makes risk management all the more difficult.

3.2. Contaminants

The foods we eat partake in the development and construction of our organism. Their quality is therefore essential for good health. Nevertheless, our meals may contain products that are not natural, for instance pesticide residues related to agricultural practices, chemical residues contained in some food packaging or pollutants present in the environment. These are known as contaminants, which can be classified in two categories:

- natural contaminants
- contaminants resulting from human activity

Metals are also to be considered as they can belong to both categories.

In this study, we only examine contaminants resulting from human activity. These can be drug residues (antibiotics, hormones), pesticide residues, pollutants (heavy metals, dioxins, etc.), residues of materials in contact with food (phthalates, mineral oils, etc.). A study[44] conducted by Générations Futures in 2013, analysing the menus of a 10-year-old, revealed that the food eaten in one day contained 128 chemical residues on average. These substances can be detected at very low levels. These contaminations are nevertheless regulated and controlled throughout the various sectors in order to limit any toxicological risk.

A few dates:

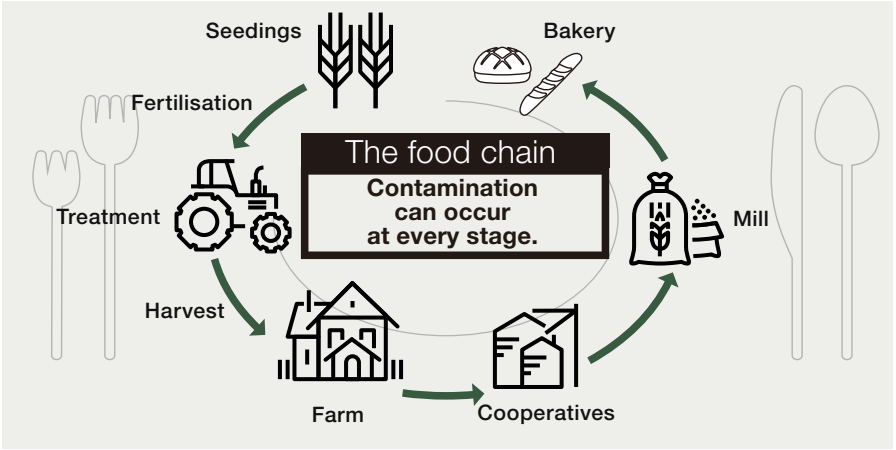
1000 : use of sulphur
1100 : first use of arsenic
1929 : development of the agri-food industry

[43] *http://www.efsa.europa.eu/en/topics/topic/aspartame*

[44] *https://www.generations-futures.fr/actualites/etude-exppert-1-exposition-aux-pesticides-perturbateurs-endocriniens/*

1930 : development of chemical weapons in warfare
1943 : launch of DDT, synthetic pesticides
1944 : launch of 2,4-D herbicide
1955 : development of fungicides of the linuron and diuron type
1961 : inventory and controls on additives, Codex Alimentarius
1970-80 : development of pyrethroids
1996 : mad cow disease
1999 : dioxins

How is food contaminated?



Source : Amundi 2017

3.2.1. Pesticide residues

Pesticides[45] are used by farmers or livestock breeders to improve yields. They protect crops from the spread of micro-organisms, pests or insects. The suffix "-cide" means that they are designed to kill living beings. They are also used to protect public health by fighting tropical diseases.

However, pesticides are also potentially toxic to humans[46]. They may have adverse effects on health: neurological or behaviour disorders (Parkinson's, Alzheimer's, autism, etc.), development of certain cancers, fertility or reproduction disorders, etc. The European Food Safety Agency (EFSA) notably issued a warning in late 2013 on neonicotinoid insecticides, which could be toxic for the nervous system. According to the WHO, every year, there are one million serious poisonings

[45] *The terms pesticides or "plant protection products" encompass herbicides, fungicides, parasiticides, acaricides, biocides, algaecides and insecticides, etc.*

[46] *http://apps.who.int/iris/bitstream/10665/36949/1/WHO_TRS_114_fre.pdf*

around the world due to pesticides and around 220,000 deaths. The people most concerned are professionals who use these products, amateur users and people living near vineyards and orchards, for example.

At the time of writing of this study (10/05/2017), the European Union did not wish to classify pesticides according to their potential effects on health. Nevertheless, the same classifications[47] [48] as for endocrine disrupters are used, with different categories, e.g. carcinogenic (may cause cancer), neurotoxic (may cause damage to the brain) or teratogenic (may cause damage to the foetus). This classification process, known as "danger identification", is the first step in "risk assessment". Tests are performed before a product is authorised for use to evaluate the possible effects on health. These effects vary depending on the dose of exposure, the time and the route of exposure (ingestion, inhalation or injection, for example).

3.2.2. Drug residues

Antibiotics are used in veterinary medicine to treat a sick animal or prevent disease in animals exposed to a known risk. There are several families of antibiotics (penicillins, aminoglycosides, cyclins, quinolones, etc.), with different modes of action. However, they have a common characteristic: they kill or limit the growth of pathogenic bacteria. These are the same antibiotics that are used in humans.

The farm animals most frequently treated are those bred for meat production, notably chickens, cattle, sheep and pigs.

Antibiotics are also administered to farm animals as a growth promoter. Their intake can increase an animal's weight by 3% (this practice is prohibited within the eurozone).

Unfortunately, practices in recent years have shown increasing, and sometimes unjustified, use of antibiotics.

3.2.3. Pollutants

Pollutants, resulting from environmental, man-made or natural contamination, can be found in the environment, soil, water and the atmosphere. They can contaminate food: this is the case of dioxins, PCB, chlordecone, methylmercury, cadmium, brominated flame retardants, etc. These pollutants tend to accumulate in animal fats and fatty fish. They are also likely to pose a risk to human and animal health.

Dioxins

Dioxins appear accidentally in food products. They result from the incomplete combustion of organic molecules and have more than 200 different molecules with varying degrees of toxicity. Dioxins have a high thermal stability and are poorly biodegradable. They are insoluble in water but highly soluble in fat, which

[47] *http://www.inserm.fr/actualites/rubriques/actualites-societe/pesticides-effets-sur-la-sante-une- expertise-collective-de-l-inserm*

[48] *http://www.agritox.anses.fr/php/fiches.php*

encourages their accumulation in fatty tissue where they can persist for a long time. They then accumulate throughout the food chain and are therefore found in high fat foods such as fish, shellfish, dairy products and eggs.

Their health effects are not well known. Dioxins accumulate in the liver and adipose tissue (e.g. breast milk).

PCBs (polychlorinated biphenyls)

Unlike dioxins, PCBs are industrially manufactured molecules. Like dioxins, however, PCBs are poorly biodegradable. In France, they have been prohibited since 1987. PCBs were used for their insulating properties and their chemical and physical stability (inks, paints, electric transformers, etc.). 30 years later, despite their ban, PCBs can still be found in the environment and in food.

In the event of heavy exposure, they have multiple effects on health: skin (chloracne, nail and skin pigmentation), eyes (hypersecretion) and liver disorders (transient alteration of the activity of liver enzymes). At low doses and for extended periods, their effects are more worrying: neurobehavioural, metabolic disruption, effects on the thyroid. In food, PCBs are found mainly in fatty fish in polluted waters.

BFRs (brominated flame retardants)

In the same way as PCBs, BFRs are man-made chemicals, used in many fields (plastics, textiles, electrical/electronic appliances) to make products less flammable.

A number of BFRs are now banned or limited in Europe due to their persistence in the environment. There are very few studies on BFRs but there are enough outstanding concerns about their risks for human health for them to be limited or banned[49].

When a product is treated with brominated flame retardants, it then releases them in the environment and contaminates the air, soil and water, not only when it is used, but also when it is disposed of. These contaminants can then enter the food chain (e.g. fish, meat, milk and its derivatives).

Metals

Present in the natural state, heavy metals such as arsenic, cadmium, lead and mercury can be found in food products in the form of residues. The accumulation of these metals can have harmful effects on human health in the long term: mercury can cause Minamata disease[50] and lead can cause lead poisoning[51].

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[49] *Étude de l'alimentation totale française 2, Anses, Juin 2011 (France's Total Diet Study 2, June 2011, Anses). https://www.anses.fr/fr/system/files/PASER- 2006sa0361Ra1.pdf*

[50] *Minamata disease is mercury poisoning, the main symptoms being: restriction of visual field, sensitivity disturbances, ataxia, alterations in speech, hearing and walking, tremors, mild mental disorders.*

[51] *The main symptoms of lead poisoning are: abdominal pain, nausea, vomiting, diarrhoea, stunted mental development in children, with irreversible sequelae in adults if poisoning affected the embryo, foetus or young child, paralysis, kidney dysfunctions, high blood pressure, risks of male infertility, hyperuricemia and cancer.*

3.2.4. Material residues in contact with foodstuffs

Food packaging can contain toxic substances which can migrate into foodstuffs by contact.

Mineral oils (MOH)

Mineral oil hydrocarbons (MOH) consist of mineral oil saturated hydrocarbons (MOSH) and mineral oil aromatic hydrocarbons (MOAH). These substances are found in cardboard packaging and inks and are suspected of being carcinogenic and mutagenic. At the date of publication of this study, there are no regulations on mineral oils. On 9 May 2017, the French governmental agency dealing with sanitary safety, ANSES, recommended limiting consumer exposure by imposing "MOAH-free printing inks, glues, additives and processing aids in the manufacturing process for paper and cardboard packaging".

The agency placed emphasis on the genotoxic and mutagenic properties of MOAH.

Phthalates

Phthalates are commonly used in plastics to make them more flexible, transparent and increase their life. Phthalates are attracted to fat and fatty alcohols. As a result, they can migrate passively from food packaging to fatty products such as cheese, for example. There are several types of phthalates and effects vary from one phthalate to another. They can be reprotoxic and teratogenic (reduced fertility, testicular atrophy, foetal weight reduction, increased foetal mortality, deformities, etc.). Some phthalates are also suspected of being endocrine disruptors.

Phthalates in food packaging are not banned either by the European Union or by the FDA[52].

3.2.5. Regulatory context and debates

Toxicity and endocrine disruption of pesticides

Each year, in many countries such as France, analyses of pesticide residues in food are carried out. The purpose is to evaluate if there are pesticides and if the legal rate is exceeded. Several studies conducted by INRA[53] show that residues from an isolated pesticide have little impact on human health under the thresholds provided for by law. On the other hand, the health consequences resulting from the presence of several pesticide residues are not well known. This is known as the cocktail effect[54]. As explained by Marc Audebert, toxicologist at the INRA: "It was observed that each molecule taken separately had little or no toxic effect on

[52] *The FDA, the US Food and Drug Administration. Its main mission is to give drug marketing authorisations in the United States.*

[53] *INRA is the French National Institute for Agronomic Research*

[54] *http://www.inra.fr/en/Scientists-Students/Food-and-nutrition/All-reports/Cocktail-effects-of-toxic-substances/The-cocktail-effect-of-pesticides*

the cells, while mixed at low doses (cocktail, or mix, effect), there was an effect on DNA damage and toxicity".

The impact on DNA is a cause of concern as mutations inside cells may have a carcinogenic effect over the long term.

Nevertheless, there are still few studies on the health effects of ingesting low quantities of pesticide residues over a long period. But many investigations showed the presence of pesticide residues in food. The DGCCRF's monitoring plan[55], published in 2013, shows the presence of pesticide residues in almost 58% of the lettuce samples tested. These commonly encountered residues are suspected of being endocrine disruptors. This was demonstrated by the NGO Générations Futures with the publication of a series of surveys on pesticides, entitled "EXPPERT: Exposition aux Pesticides PERTurbateurs Endocriniens (exposure to pesticides and endocrine disruptors)[56].

Are pesticide residues dangerous?

In 2011, François Veillerette, the spokesman for Générations Futures, said: "*The quantities found may appear small, a few dozen or a few hundred microgrammes per kilo maximum. This may sound like a small amount, but if you compare it with the levels that are acceptable in water, it is in fact quite a lot. And what really worries us is a category of these pesticides known as endocrine disruptors, i.e. which can interfere with the hormonal system and disrupt its functioning, and can have effects at very low doses, all the more so in that there is not just one molecule present at a time, but a cocktail of these molecules. And this raises specific questions on endocrine disruptors, as the dose limits that are supposed to guarantee an absence of effects are no longer relevant, because we know that pregnant women and foetuses are especially sensitive to this product, even at low doses.*"

Antibiotic resistance

Antibiotic resistance is a natural phenomenon. But in recent years, the intensive use of antibiotics on farms has been accentuating this phenomenon. Antibiotics, at the doses at which they are used, are not directly harmful to humans. The molecules act on the bacterial system and not on human cells.

The risk here is indirect. Some infections or diseases can be transmitted directly or indirectly between man and animal - this is known as zoonosis. The severity of these diseases in humans ranges from simple symptoms to more severe conditions that can result in death.

[55] *French General Directorate for Competition Policy, Consumer Affairs and Fraud Control (DGCCRF)*

[56] *https ://www.generations-futures.fr/?s=exppert*

EFSA estimates that between one third and one half of human infectious diseases are of zoonotic origin (transmitted by animals).

Antibiotic resistance refers to the resistance of a bacterium to an antimicrobial agent to which it was previously sensitive. The mass or inappropriate use of antibiotics fosters the emergence and spread of micro-organisms that become resistant, making treatments ineffective and constituting a serious risk to public health.

If antimicrobial resistance appears in zoonotic bacteria present in animals or food, it can compromise the effective treatment of infectious diseases not only in humans, but also in animals.

In this context, EFSA published in 2010 its first report on antimicrobial resistance in zoonotic bacteria in animals and food, covering the years 2004 to 2008. This report notably highlights the impact of the mass or inappropriate use of antibiotics and their effect on the resistance of some bacteria to some classes of antibiotics.

According to the World Health Organization (WHO), at least 61% of pathogens affecting humans are zoonoses and three-quarters of the diseases that emerged over the last decade are of zoonotic origin. The WHO considers “antibiotic resistance as one of the most serious threats to global health, food security and development”.

Regulations and controls

Regulatory framework

Rates of residues authorised in food products are framed by European legislation. Risk assessment will make it possible to qualify the presence of pesticide residues in food, the goal being to set a safe level of absorption. Several measures are analysed. The NED is the no-effect dose, i.e. the dose below which scientists have observed no effect on animals. This dose is then used as a reference to calculate the ADI. The ADI is the acceptable daily intake defined by dividing the NED by a factor of 100 to 1,000. This is what is known as the safety factor: a factor of 10 to account for the differences between animals and humans, multiplied by another factor of 10 to account for possible differences in sensitivity between humans. Safety factors can vary up to 1,000 depending on the classification of the active substance. ADIs are set by the EFSA, WHO or FAO. The acceptable daily intake therefore corresponds to the amount of residues that can be ingested by an average 60kg individual every day of his life without risk to his health.

Finally, each food product must meet the regulatory concentration threshold, the maximum residue level (MRL). The MRL takes into account the substance’s toxicity and the possible exposure of the consumer of foodstuffs. Above this threshold, a food product is no longer authorised on the market. The goal is to prevent the average consumer from ingesting an active substance in excess of the ADI. MRLs are set by the European Commission at community level and by the Codex Alimentarius at international level. By definition, they are lower than the ADI, which is itself lower than the NED (MRL < ADI < NED).

Checks

Since 1996, the European Commission, notably the Directorate General for Health and Food Safety (DG SANCO), has made controlling contaminants one of its priorities. Many checks are carried out throughout the value chain, from field to fork, in order to prevent any unacceptable risk for the consumer. In France, checks are carried out by the veterinary services in conjunction with the fraud repression services, which in turn are inspected by the Commission's Food and Veterinary Office (FVO). Foods with levels exceeding these standards cannot be marketed. This is notably the case for foods containing PCBs, methylmercury, cadmium, etc.

Based on the checks carried out, these organisations may also make recommendations to the competent authorities to reduce consumers' exposure.

3.3. Special cases

3.3.1. Palm oil

Key palm oil issues[57]

Palm oil, used mainly and on a massive scale today by the agri-food and cosmetic industries, is severely criticised.

It is the most consumed vegetable oil in the world. With 62 million tonnes produced annually, it represents 38% of the world production of vegetable oil, while it occupies less than 10% of the surface of vegetable oil crops. Indonesia and Malaysia are the main producers and provide 85% of palm oil[58].

However, oil palm cultivation is accused of contributing significantly to the destruction of primary forests, mainly in Indonesia and Malaysia, causing irreversible harm to biodiversity and huge fires, with extremely serious health consequences on local populations and on those of neighbouring countries. In addition, oil palm cultivation gives rise to many social conflicts due to the non-respect of local communities' rights to their land, and this holds true for all producing countries.

Finally, palm oil has often been called into question for its high content in saturated fatty acids, which are believed to increase the risk of cardiovascular disease.

Palm oil on labels

Europe

Since 13 December 2014, European regulation no. 1169/2011 requires that refined oils of plant origin no longer be grouped under the term "vegetable oil". Their name must be immediately followed by that of the plant from which they are made.

[57] *Cf. study "Oil palm: the environmental dilemma", Amundi 2017*

[58] *Oil world, 2016*

Canada

In the same way as for European Union countries, the common name of a vegetable oil must feature on the principal display panel of the package and the exact name must be specified[59].

Impact on health

From a nutritional point of view, palm oil is similar to butter. Palm oil is therefore no more harmful than other fats. In fact, there is no such thing as a "good" or "bad" oil as none of them contain a complete spectrum of essential fatty acids. The relationship between fatty acids and obesity, or fatty acids and cardiovascular disease, is complex. However, the major disadvantage of palm oil lies in the fact that it provides only one main saturated fatty acid: palmitic acid. In unbalanced diets, this acid accumulates in the body[60].

3.3.2. Nanoparticles in food

Situational analysis

Nanoparticles, ranging in size from about 100 nanometres down to about 1 nanometre, have been widely present in the daily lives of consumers for several years. While they hold out hope in the medical field, they are more of a source of concern in agri-food and cosmetics[61].

At the end of 2013, European consumers should have seen the term "nano" feature on the label of the products concerned, in compliance with the INCO regulation[62].

However, in December 2013, European institutions disagreed about the labelling: the European Commission suggested exempting additives that had already been in use for several years from the mandatory "nano" indication, arguing this could cause confusion among consumers by suggesting their use was new. Another transparency issue was also being debated, with the EU Commission focusing on whether the number size distribution threshold of 50% should be increased or decreased, whereas the European Food Safety Agency (EFSA) recommended a threshold of 10% given the lack of certainty about the risks incurred by using nanotechnology.

In March 2014, the MEPs rejected the Commission's proposal. The new version has still not been finalised.

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[59] *http://www.inspection.gc.ca/aliments/etiquetage/l-etiquetage-des-aliments-pour-l-industrie/matieres-grasses-et-huiles/fra/1392751693435/1392751782638*

[60] *Amundi Discussion Papers Series DP-23-2017, June 2017*

[61] *http://www.60millions-mag.com/2015/03/19/nanoparticules-dans-les-aliments-la-loi-du-silence-7988*

[62] *INCO regulation: Regulation No. 1169/2011, or INCO, published in the OJEU on 22 November 2011, concerns information to consumers on food. This information must not mislead consumers. The INCO regulation updates, simplifies and clarifies the labelling of foodstuffs sold in the European Union. http://www.economie.gouv.fr/dgccrf/etiquetage-des-denrees-alimentaires-nouvelles-regles-europeennes*

In 2016, the European Commission also postponed to 2018 the change in the REACH regulation on chemicals to adapt it to the characteristics of nanometric powders[63].

Meanwhile, manufacturers played for time, declaring, via the French National Association of Food Industries (ANIA) that "the concept of nanomaterials was shifting and was the subject of several definitions". As soon as a definition has been adopted officially, labelling can be put in place.

According to the French Association of intelligence and civic information on nanoscience and nanotechnology issues (Avicenn), "*Many professionals ignore the specific nano nature of the substances they use, which hinders the labelling process and therefore information to consumers*"[64].

Main uses of nanomaterials in food products

In the agri-food sector, nanomaterials are used either as such, or incorporated into polymers:

- organic nanomaterials: nanocapsules or lipid, protein or polysaccharide-based nanospheres. They contain food additives, drugs or pesticides
- inorganic nanomaterials: metals and mineral elements
- combined organic-inorganic nanomaterials: in packaging

Nanotechnologies have interesting applications in food products and packaging, also in plant protection products. Using nanotechnology can or could[65] [66]:

- "improve" the health profile of food products such as soft drinks, ice cream, chocolate or French fries by reducing fat, carbohydrates or calories or by increasing the content in protein, fibre or vitamins; for example, researchers can transform grains of salt and particles of nanometric size, offering far greater exchange areas and thereby decreasing the amounts of salt in a product for an equivalent taste. Another use could be to encapsulate vitamin supplements or mineral salts in the form of nanoparticles in order to provide more vitamins or minerals in products consumed on a daily basis.
- help produce flavourings, colouring agents or additives, increase production rates and reduce costs;
- develop foods that are capable of changing colour or nutritional properties based on consumers' dietary needs, allergies or taste preferences.

Some examples of nanomaterials that may be used in nanoscale form:

- calcium carbonate ((E170), a white surface colouring agent,
- titanium dioxide (E171) used in salad dressings, confectionery and chewing gum,

[63] *http://www.liberation.fr/futurs/2016/05/20/nanomateriaux-un-non-a-particules_1454133*

[64] *Ibid*

[65] *http://libcloud.s3.amazonaws.com/93/25/c/4723/2014_Tiny_ Ingredients_ Big_ Risks_Web.pdf*

[66] *https ://www.theguardian.com/what-is-nano/what-you-need-know-about-nano-food*

as well as in toothpastes. It is used in particular to increase the whiteness or brightness of food or else change the hues of other types of colouring agents[67]. It is not labelled as a nanomaterial, however, as it is only partially in this form (10 to 40%, i.e. less than 100nm), the rest being in micro-particle state.

- iron oxide (E172) for red, yellow or black colours in confectionery, biscuits or casings for sausage products.
- silicon dioxide (amorphous silica, E551) used as an anti-caking agent; permitted in micrometric form, but contains a proportion of nanoparticles,

In packaging, they can be used as[68]:

- barriers against outside elements, namely air, UVs or pathogens, extending products' shelf life
- active materials with antimicrobial minerals or oxygen sensors;
- smart materials for the detection of pathogens and chemicals, temperature and humidity monitoring;
- antimicrobial coatings.

Some examples of nanomaterials used in packaging:

- Clay nanocomposites as a waterproof barrier to gases such as oxygen or carbon dioxide in bottles, boxes or packaging films[69],
- Zinc in food packaging to block UVs and provide anti-bacterial protection, while improving the resistance of the pack's plastic film.
- Silver nanoparticles to kill harmful bacteria.

Potential health risks

There are few reports on the health impact of nanoparticles. However, in a 2014 report by the French governmental agency dealing with sanitary safety (ANSES) on the assessment of risks associated with nanomaterials, some animal toxicity risks are listed, notably[70]:

- The persistence of nanomaterials in living organisms
- Stunted growth, anomalies or malformations in development or reproduction
- Crossing of some physiological barriers
- Genotoxic and carcinogenic effects
- Effects on the central nervous system
- Allergies, etc.

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[67] *http://www.lemonde.fr/sante/article/2017/01/20/alerte-sur-les-dangers-du-dioxyde-de-titane-un-additif-alimentaire-tres-courant_5066297_1651302.html*

[68] *http://www.nanoresp.fr/les-nanomateriaux-dans-lalimentation-quelques-reperes/*

[69] *http://www.understandingnano.com/food.html*

[70] *https ://www.anses.fr/fr/system/files/AP2012sa0273Ra.pdf*

In addition, according to a study the INRA has been conducting for four years, titanium dioxide (E171) could promote the growth of precancerous lesions in rats.

3.3.3. GMO

Definition

A genetically modified organism (GMO) is an organism (plant, animal, bacterium, virus) in which one or more genes are introduced artificially, either genes unknown to the species to which this organism belongs, or else belonging to this species but having undergone several genetic manipulations. The introduction of these genes leads to the production of proteins that attribute new characteristics to the genetically modified organism[71].

GMO labelling

Mandatory GMO labelling in Europe - Regulation (EC) no. 1829/2003 and 1830/2003[72]

In the European Union, all products that deliberately contain GMOs must be labelled, whatever the amount of GMOs contained in the product. If the product inadvertently contains GMOs, traces are allowed up to 0.9% per ingredient with no specific labelling obligations.

There are exceptions, however, and they are significant:

- Products derived from animals fed with GMOs (milk, meat, eggs). And yet 80% of GMOs are imported into Europe for animal feed.
- Hidden GMOs, i.e. GMO foods that escape European regulation.
- Food served in the restaurant and catering sectors.

"GMO-free" labelling, decree no. 2012-128

In France, voluntary "GMO-free" labelling since 2012. This labelling, still barely used, also exists in Germany and Austria. It can be applied to plant and animal products and beehive products.

This labelling applies in the following cases[73]:

- Plant-based ingredients come from raw materials that contain "less than 0.1% of GMOs (fortuitous presence)".
- Animal-based ingredients (milk, meat, fish or eggs) with less than 0.1% or 0.9% of GMOs. The level of guarantee is specified in the indication: "from animals fed without GMO (< 0.1%)" or "from animals fed without GMO (< 0.9%)".

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[71] *http://www.lyc-ferry-conflans.ac-versailles.fr/Disciplines/SVT/MISVT/2nde3-07-08/OGM/Claire-Lucie/definition-ogm.htm*

[72] *https://www.infogm.org/faq-etiquetage-avec-ou-sans-OGM-en-France-et-en-Europe*

[73] *https ://www.economie.gouv.fr/dgccrf/consommation/Etiquetage-des-produits/OGM*

– Ingredients of bee origin may be labelled “without GMOs in a radius of 3 km”, subject notably to this distance between the hives and the fields of genetically modified crops being complied with.

Some labels guarantee the absence, or virtual absence, of GMOs:

– Agriculture Biologique (organic farming) (presence < 0.9%)

– Agriculture Biologique with private specifications, e.g. Bio Cohérence, Demeter and Nature & Progrès (total ban)

Labelling in the United States[74]:

In July 2016, President Obama signed a bill to implement a federal standard for foods made from genetically modified organisms. Specific details must be developed by the Ministry of Agriculture, which has two years to draft the implementing rules. Labelling is not required before the adoption of the final text.

[74] *http://abcnews.go.com/US/obama-signs-bill-mandating-gmo-labeling/story?id=41004057*

IV. Assessment of corporate performances

4.1. Analysis methodology

For this study, we contacted 17 companies from five sectors and five countries.

We selected these companies for their connection with the theme. Companies in the agricultural product sector chose not to respond, unlike food retail companies and soft drink manufacturers, which have a response rate of 100%.

However, despite the lack of availability and involvement of a number of companies, all 17 companies were evaluated through publicly available information.

	Number of companies contacted	Number of responseS	% responses
Agricultural products	2	0	0%
Food retailing	2	2	100%
Agri-food	5	3	60%
Restaurants	6	4	66%
Beverages	2	2	100%
Total	**17**	**11**	**64%**

Source: Amundi 2017

We interviewed companies on nine themes that we considered relevant:

- Nutrition
- Food additives
- Responsible marketing
- Pesticides
- Antibiotics
- Nanoparticles
- GMOs
- Information present on the labels
- Controversies

4.2. Main analysis findings

Companies in the retail sector have better results with an average score of 3.3 on 5.

	Average rating
Agricultural products	1.43
Restaurants	1.54
Agri-food	2.08
Beverages	2.13
Food retailing	3.30
Average	**1.96**

Source: Amundi 2017

Some areas comply with the regulations and others go further, placing emphasis on the precautionary principle and consumer health.

Nutrition:

For the nutrition criterion, even if some companies stand out, the results are fairly homogeneous.

Only one company has not implemented a nutrition policy or set any objectives.

However, our study shows that many engagements are qualitative. The score for the results section is low, as companies have not really developed processes for analysing and evaluating initiatives, except for food retail companies and two agri-food groups which are a little more mature on the subject and are starting to analyse results.

Note that agricultural product companies are not concerned by this criterion.

Food additives

82% of the firms surveyed have not implemented any specific policy on additives. Only food retail and one company in the food sector go beyond the regulation. The retail sector places greater emphasis on the precautionary principle, with notably one company that has excluded 60 controversial but authorised additives.

These companies have also implemented specific objectives such as the exclusion of all artificial colourings by 2020.

Responsible marketing

By responsible marketing, we refer here to how companies communicate on packaging in the case of agri-food groups, on own-label brands in the case of supermarkets, or provide customer information in the case of catering. We have adopted a comprehensive approach as claims are highly regulated. Infractions will be highlighted in the section on controversies.

On the whole, the companies reviewed provided little additional information. This criterion proved difficult to assess as companies mostly comply with the regulation. Some efforts deserve to be highlighted, however, concerning children's products.

Pesticides

30% of the companies surveyed have a succinct policy and 47% have no policy. For the companies that are engaged, initiatives include focusing on a product category, e.g. pesticide residue free frozen vegetables, or restriction on pesticides used in potato farming.

Antibiotics

In the same way as for pesticides, few companies commit to using antibiotics moderately or to stop using them altogether. 52% of the groups in our sample have not implemented a policy on the use of pesticides. A few initiatives are gradually being implemented for one type of meat (poultry), with animals raised without antibiotics. These new ranges are intended to be developed for other meat products in the future.

Nanoparticles

58% of the companies surveyed provided no information. The subject of nanoparticles remains nascent, multi-sectoral and taboo. The practices of all of the companies surveyed have proved to be immature. For this criterion, we analysed information availability. Given the challenge posed by nanomaterials, rating criteria are likely to evolve over time. Companies interested in the subject report that it is very difficult to get information on this theme. Two companies apply the precautionary principle, however, and ask their suppliers not to use ingredients in nanometric form. There is a lack of transparency on the subject.

GMOs

All the companies surveyed say they comply with the regulations in force, but no company has made a global engagement.

Only 23% of companies have committed to using GMOs in a purely commercial way, i.e. based on local markets and consumers' requirements.

In the United States, where the use of genetically modified ingredients is permitted, two companies offer GMO-free products for clients seeking natural products.

Information present on the labels

This criterion enables us to assess companies' proactivity in anticipating regulations on client information, for instance, displaying nutritional information, information on their carbon/environmental footprint, on pesticide-free products, etc.

It has been neutralised for the agricultural product and catering sectors, with the exception of two companies which are multiplying initiatives, for instance, by displaying nutritional qualities on their packaging.

The average score is 3.33. Companies have implemented many initiatives. Some of them go beyond the regulation on certain product lines.

Three companies are in favour of using the Nutri-score and display it on a selection of products.

That said, there is some doublespeak at a number of companies: they claim to be in favour of transparency but also lobby actively to limit the display of nutritional information.

Controversies

Unlike for many other issues, like for example, mining pollution or toxic chemicals in textiles, campaigns to combat additives, nanomaterials or pesticides seldom cite companies by name. They focus more on the sector.

There are many controversies mentioned in this document but the investigations conducted do not reveal names.

This indicator therefore contributed little by way of a discriminatory criterion for our evaluation.

Conclusion 1

Nutrition is the best documented issue of this study. Our sample groups provide a lot of specific information and propose indicators to assess the efforts made and results achieved more readily. The topic is widely discussed in public documentation sources.

Conclusion 2

The food retail sector communicates more and is more sensitive to the reputational risk, notably in relation to additives, pesticides and antibiotics.

Conclusion 3

Nanoparticles remain a taboo subject. Some companies prefer not to address the subject. In our view, companies underestimate the risk and do not see the need to communicate more on the subject.

The most likely reasons are fairly similar to those mentioned in the Discussion Paper on endocrine disruptors, namely that:

- The health consequences could affect a large number of people;
- It is currently virtually impossible to make a connection between nanoparticles and diseases;
- Companies have a risk-based approach instead of a danger-based approach;
- The risks are not yet sufficiently known by the general public;
- The regulation on nanoparticles is not sufficiently well developed.

Study limits:

- The results observed in this study only represent sector trends;
- The sample of companies surveyed is small compared with the number of companies in each sector;

- There is a geographical bias on the companies studied;
- Interviewed stakeholders did not occupy the same functions. The information provided may also be biased on this point;
- The issues differ according to the sector.

4.3. Our recommendations

Given current business practices, we recommend that companies:

- Evaluate the impact of initiatives and measures put in place to encourage better nutritional practices
- Commit to fighting antibiotic resistance by limiting their use to the weaning period
- Establish more restrictive limits on pesticide residues
- Show transparency on issues such as additives, GMOs and nanoparticles
- Support additive analysis processes and specify usage recommendations
- Extend the scope of initiatives designed to protect the consumer in their entire scope

Conclusion

This study allowed us to determine the disparities between the issue of transparency on the composition of food products and the practices of companies in our sample. The analysis of these issues was necessary as part of the ESG (Environment Social Governance) expertise in order to better understand and analyse the regulatory issues facing manufacturers, the consumers' concerns and, lastly, the opportunities and risks arising therefrom.

In general, the information published varies considerably from one sector to another, within each sector and depending on specific issues. That said, information on the efforts undertaken and carried out on nutrition and engagements for responsible marketing is generally available. On the other hand, what we lack are precise indicators to evaluate the concrete results of actions and programmes. Concerning labelling per se, few companies in our sample are pioneers in showing more transparency than that imposed by the various local regulations.

Turning to emerging and controversial subjects, there is room for improvement in terms of transparency and companies' proactivity in adopting more responsible production methods and improving knowledge on the substances used in processed foods. This is notably the case of the nanoparticles used in the food industry. In a regulatory environment that is still hazy at the date of publication of this study, companies are still very opaque on the subject. Information is scarce while the health consequences are still unknown and the precautionary principle is little applied. In addition, some additives, although they have been used for very many years, are severely criticised for their potential adverse impact on health. That said, the groups in our sample do not communicate sufficiently. Public information is rare and little documented.

Contaminants are another point of attention. The results are fairly mixed. While regulatory obligations require groups to communicate about product ingredients, no clearly accessible information is available that can enable consumers to know the precise content in pesticide residues, chemicals or other potential contaminants, apart from a few labels. This is despite companies' undertaking to comply with regulatory thresholds.

However, on this subject, some sectors are working on offering products free of post-harvest chemical treatments or antibiotic-free poultry sectors. More generally, even if the information provided by the groups is insufficient, transparency is progressing.

Annexes

Nutrition

Proteins

Proteins are large molecules made up of chains of variable length of amino acids. All proteins are made up from a group of 20 amino acids.

Proteins are of animal (meat, fish, eggs, milk, etc.) or plant origin (cereals, pulses, oilseeds, etc.).

Food proteins are a source of energy (the degradation of amino acids releases energy equivalent to that provided by carbohydrates), but this is not their main function. The body uses amino acids released during digestion for the synthesis of its own proteins. These form the basic material for all the cellular infrastructure of tissues, organs and vital substances such as enzymes, antibodies, hormones, neurotransmitters, etc.

They are necessary for the[75]:

- Body's growth and development,
- Maintenance, healing and replacement of worn-out and damaged tissue
- Production of metabolic and digestive enzymes,
- Constitution of hormones such as thyroxine and insulin.

Proteins consumed in excess of the ration necessary for growth, the renewal of cells and biological fluids and various other metabolic functions, are transformed into carbohydrates and stored for energy.

The body is able to produce by itself 12 amino acids from other nutrients such as glucose, but it must find the other eight amino acids in food. The latter are known as "essential": phenylalanine, tryptophan, methionine, lysine, leucine, isoleucine, valine and threonine. The other amino acids are: glycine, alanine, serine, cystine, tyrosine, aspartic acid, glutamic acid, proline, hydroxyproline, citrulline and arginine. Each protein has a specific mixture of amino acids that may or may not contain the eight essential amino acids.

During digestion, proteins are separated into peptides and amino acids.

Lipids and fatty acids

Lipids include all liquid and solid body fats and fall into two groups: structural fat and reserve fat. Lipids are composed of carbon, hydrogen and oxygen. They are insoluble in water.

[75] *http://www.fao.org/docrep/004/w0073f/w0073f10.htm*

Food lipids consist mainly of triglycerides. These lipids can be broken down into glycerol and fatty acids, which are chains formed of carbon, hydrogen and oxygen. Fatty acids in human food fall into two groups: saturated fatty acids and unsaturated fatty acids. These can be monosaturated or polyunsaturated.

All dietary fats contain saturated or unsaturated fatty acids in varying proportions. Generally speaking, animal fats contain more saturated fatty acids and vegetable fats more unsaturated fatty acids, and especially polyunsaturated fatty acids (PUFA). This distinction is important for health, as an excessive consumption of saturated fats is one of the factors of atheroma[76] and coronary heart disease. PUFA, on the contrary, seem to have a protective role.

Lipids give food a more pleasant taste.

Carbohydrates

Carbohydrates are composed of carbon, hydrogen and oxygen (in the proportion 6:12:6).

In human nutrition, they are represented by starch and other sugars. They fall into three groups:

- Monosaccharides: glucose (fruits, sweet potatoes, onions), fructose (honey, fruits), galactose (milk / the digestion products of lactose are glucose and galactose)
- Disaccharides: saccharose or sucrose (sugar beet, sugar cane, carrots, pineapples), lactose (milk), maltose (sprouts). They are composed of two simple sugars. They are split into monosaccharides to be digested in the intestine.
- Polysaccharides: starch, glycogen and cellulose. These are the most complex sugars. Starch is a major energy source, found especially in cereal seeds and root vegetables.

Dietary fibre

Dietary fibre consists of indigestible carbohydrates of plant origin, and is not therefore a nutrient. There are soluble and insoluble fibres. They help regulate the transit and have an action on cholesterol and blood sugar[77].

Minerals

Minerals have several functions in the body. They can come in the form of salts in biological fluids, where their role is to maintain osmotic pressure. They are also present in many tissues and are essential components of some hormones.

The most important minerals in human nutrition are calcium, iron, iodine, fluorine and zinc.

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[76] *Collins English Dictionary definition: A fatty deposit on or within the inner lining of an artery, often causing an obstruction to the blood flow https://www.collinsdictionary.com/dictionary/english/atheroma*

[77] *https://alimentation.ooreka.fr/comprendre/fibres-alimentaires*

Calcium

Calcium plays a major role in building the bone structure and in various metabolic functions: muscle activity, nervous stimuli, enzymatic activities, hormonal activity and oxygen transport.In food, calcium is found essentially in milk derivatives, pulses and vegetables.

Iron

The majority of iron is in the form of haemoglobin in red blood cells. The rest is in the myoglobin or as reserves in the liver, spleen and bone marrow.

The essential function of iron is transporting oxygen in the body. It is also present in several enzymes.

In the diet, iron is provided essentially by meat, fish, eggs, pulses and green leafy vegetables. Although there is little iron in cereals, they are its main source when these basic foods are consumed in large quantities in emerging countries.

Iodine

Essential for the synthesis of thyroid hormones, iodine is mainly found in the thyroid gland.

Iodized salt is the main source of dietary iodine. Fish, algae and plants grown near the sea are also good sources.

Fluoride

Fluoride is mainly present in the teeth and bones. Its main source is drinking water.

Zinc

Very present in enzymes essential to the metabolism, zinc is mainly present in protein sources such as meat and seafood and eggs. It can also be provided by cereals and pulses.

Trace elements

Some minerals have a crucial importance in metabolic processes but are present in very small amounts: they are known as trace elements.

Cobalt, copper, magnesium, manganese and selenium have a nutritional role. Lead and mercury are to be considered for their potential toxicity.

Vitamins

A vitamin is “any of a group of organic compounds which are essential for normal growth and nutrition and are required in small quantities in the diet because they cannot be synthesized by the body”[78].

[78] *Larousse definition*

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October 2017

Document issued by Amundi, a société anonyme with a share capital of €1,086,262,605 - Portfolio manager regulated by the AMF under number GP04000036 – Head office: 90 boulevard Pasteur – 75015 Paris – France – 437 574 452 RCS Paris www.amundi.com

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