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# Product labels and advertising: are consumers protected or misled?

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**OPINION PAPER**

## Abstract

In this paper, we propose solutions to issues related to food and product labels, as well as advertising, which are often overlooked or ignored. To illustrate these concerns, we will examine specific categories such as beverages, additives, dietary foods, food supplements, and medical device integrators in detail. Additionally, we will discuss particular eating habits, including Mediterranean and vegan diets, ultraprocessed food (UPF), along with emerging food types like insect-based products and cultivated meat. Since labels and product advertisements can unintentionally or intentionally mislead consumers, they pose potential risks to consumer health and well-being. We evaluate various challenges associated with labelling and advertising, offering practical recommendations and potential solutions.

*Keywords*: product labels**,** product advertising, beverages, additives, dietetic products, food supplements and integrators, food intolerances, carcinogens, mediterranean and vegan diets, ultra-processed foods (UPF), novel food, food from insect, cultivated meat

## Introduction

Any product that a consumer eats, drinks, or inhales throughout their lifetime may potentially cause harm. Laws regulating product safety aim to prevent such harm. This paper advocates for consumers while also addressing everyone involved in the food and pharmaceutical production industries.

The food safety policy of the European Union (EU) is primarily governed by Articles 168 (public health) and 169 (consumer protection) of the Treaty on the Functioning of the European Union (ref. EUR-LEX1). The EU's food safety policy seeks to protect consumers while ensuring the smooth operation of the single market (ref. EUR-LEX2).

To maintain food hygiene and control contamination from external substances like pesticides and additives, the EU has established specific regulations. Each stage of production and sale is subject to rigorous controls (ref. EFSA1), and products imported from third countries, such as meat, must adhere to the same standards and undergo the same inspections as food produced within the EU.

EFSA offers independent scientific advice and risk assessments that inform EU food safety regulations. For further details on EU control systems, please consult the "Ensuring Food is Safe" Guide (ref. EFSA 2), which thoroughly outlines the entire food control framework within the EU, as illustrated in Figure 1.

The figure illustrates how the three layers of control safeguard human health. Protecting health is the primary objective of all EU laws and regulations concerning medical products, agriculture, animal husbandry, and food production. A comprehensive set of regulations at the EU level encompasses the entire production and processing chain within the European Union, as well as goods that are imported and exported (Layer 1)**.**

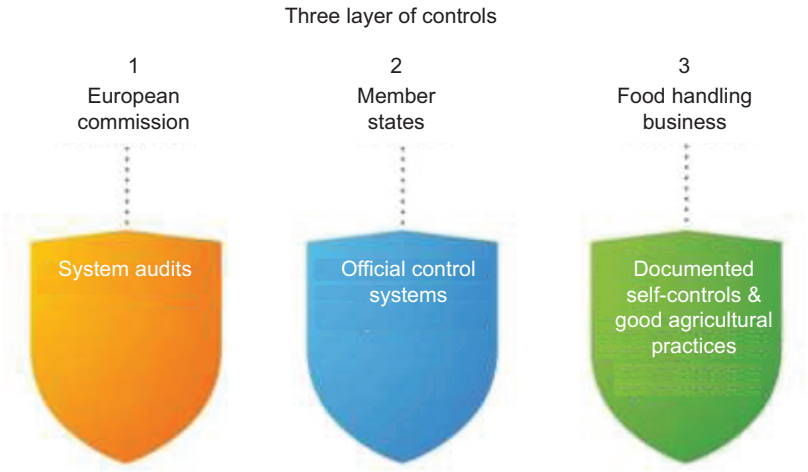


**Figure 1. (ref. EFSA 2).**

EU countries (Layer 2) implement these harmonized regulations and establish controls to enforce them. The EU monitors the application and effectiveness of these laws and controls while also providing essential training for EU officials and international authorities.

To enhance consumer protection, various institutional control systems operate within EU Member States, tasked with preventing and, when necessary, addressing potential fraud, including alterations, counterfeiting, and adulteration.

In Italy, these tasks are specifically assigned to the following entities:

1. The Central Inspectorate for Fraud Repression (ICQRF) of the Ministry of Agriculture, Food Sovereignty, and Forestry (ref. MASAF).

2. The Anti-Sophistication and Health Units of the Carabinieri, along with the territorially competent Local Health Authorities (ref. NAS).

To fulfil Layer 3, food industries are required to adhere to and implement all their designated procedures.

However, we observe that issues can arise in the application of this well-defined legislation. Some food and pharmaceutical industries interpret and apply the standards to which they are subject in their own ways. Upon closer examination, it becomes evident that there is often only a superficial adherence to the original intent of the rules. Furthermore, the abundance and complexity of the regulations, along with subjective interpretations, can lead to non-compliance.

In our view, this phenomenon is often driven by Marketing Departments, responding to directives from their Board of Directors to capture larger market shares, sometimes without fully considering the potential impact on consumer health. Therefore, it is essential to thoroughly educate personnel involved in production and marketing sectors—such as food technologists, chemists, biologists, and medical doctors—to ensure they consistently adhere to the spirit of the law. This approach will help safeguard consumer health and safety.

In the study cases that follows, we will try to highlight some of these facts and behaviours.

## Selected Study Cases

### Food Additives

The World Health Organization (ref. WHO 1) defines food additives as non-nutritive substances that are intentionally added to food, typically in small quantities, to enhance appearance, flavour, texture, and shelf life. A list of the various categories can be found in Table 1.

The Food and Drug Administration (ref. FDA 1), in collaboration with the Food Protection Committee, defines food additives as substances or mixtures that are not basic foodstuffs and are present in food as a result of any aspect of production, processing, storage, or packaging.

The most commonly used additives on food are:

1. Acesulfame K (E950)
2. Erythritol (E968)
3. Mannitol (E421)
4. Nitrites (E249-E250)
5. Nitrates (E251-252)
6. Sulphites (E220-228
7. Monosodium glutamate (E621)
8. Sodium benzoate (E211)

**Table 1. List of additives (ref. CODEX ALIMENTARIUS).**

| | |
|---|---|
| DYES from E100-199 | 100-109 – yellow<br>110-119 – orange<br>120-129 – red<br>130-139 – blue and violet<br>140-149 – green<br>150-159 – brown and black<br>160-199 – other |
| PRESERVATIVES from E200-299 | 200-209 – Sorbates<br>210-219 – Benzoates<br>220-229 – Sulphides<br>230-239 – Phenols and formats<br>240-259 – Nitrates<br>260-269 – Acetates<br>270-279 – Lactates<br>280-289 – Propionates<br>290-299 – Other |
| ANTIOXIDANTS AND ACIDITY REGULATORS from E300-399 | 300-309 – ascorbates (vitamin C)<br>310-319 – gallates and erythorbates<br>320-329 – lactates<br>330-339 – citrates and tartrates<br>340-349 – phosphates<br>350-359 – sick and adipatic<br>360-369 – succinates and fumarates<br>370-399 – others |
| THICKENERS, STABILIZERS, EMULSIFIERS from E300-499 | 400-409 – Alginates<br>410-419 – Natural rubber<br>420-429 – Other natural agents<br>430-439 – Polyoxyethylene derivatives<br>440-449 – Natural emulsifiers<br>450-459 – Phosphates<br>460-469 – Cellulose derivatives<br>470-489 – Fatty acid derivatives<br>490-499 – Other |
| ACIDITY REGULATORS AND ANTI-CAKING AGENTS from E500-599 | 500-509 – Inorganic acids and bases<br>510-519 – Chlorides and sulphates<br>520-529 – Sulphates and hydroxides<br>530-549 – Salts of alkali metals<br>550-559 – Silicates<br>570-579 – Stearates and gluconates<br>580-599 – Other |
| FLAVOR ENHANCERS from E600-699 | 620-629 – glutamates<br>630-639 – inosinates<br>640-649 - other |
| VARIOUS from E900-999 | 900-909 – waxes<br>910-919 – glazes<br>920-929 – auxiliary agents<br>930-949 – packaging gases<br>950-969 – sweeteners<br>990-999 – foaming agents |

These additives are subject to individual restrictions set by EFSA to prevent potential negative effects on consumer health. According to EU regulations, the presence of any additives must be indicated on food or drink labels either by name or by E number. Currently, this is often done using the E number. The authors strongly suggest that the EU should amend this rule to require producers to list additives by their names rather than their E numbers. This change would better inform consumers about the contents of the products they are buying, eating, or drinking.

A particular category of interest among food additives is sweeteners. Sweeteners, or sugar substitutes, are food additives used to impart a sweet taste to foods and beverages, including soft drinks, desserts, dairy products, sweets, chewing gum, and low-calorie or weight control products. Recently, the World Health Organization recommended against the use of certain sugar substitutes for weight loss, citing insufficient evidence of long-term benefits (ref. EFSA-3).

Like all food additives, new sweeteners must undergo a safety evaluation before receiving market authorization in the European Union (EU). EFSA's scientists are currently re-evaluating the safety of all sweeteners that were permitted for use in foods prior to January 20, 2009:

**Sucralose** (E955) is a molecule that is many times sweeter than sugar. In the United States, it is marketed under the brand name Splenda and is used in thousands of products, including baked goods, beverages, chewing gum, gelatins, and frozen dairy desserts. Recent studies have indicated that sucralose may not only cause DNA damage but could also contribute to a leaky gut lining and increase the activity of genes associated with inflammation and cancer (ref. FDA 2).

**Steviol** glycosides (E960) and thaumatin (E957), along with neohesperidin DC (E959), which is derived from citrus, are produced through various methods, including extraction from plants or other materials of vegetable origin.

**Cyclammates** (E952) and **saccharin** (E954) Saccharin is a synthetic molecule that is 300 to 400 times sweeter than regular sugar. Due to insufficient solid evidence linking saccharin to cancer development, its classification was changed to "Not classifiable as carcinogenic to humans" (ref. EFSA 3). However, some recent studies may reopen this discussion (ref. TOUYZ, L).

**Erythritol (**E968**)** a molecule obtained using microorganisms in the production process. In 2023, European Food Safety Authority reassessed the safety of erythritol and lowered the recommended daily intake limit to 0.5 grams per kg body weight (ref. EFSA 4)

**aspartame (**E951) is subjected to Individual restriction(s) / exception(s) (ML = 300 mg/kg, only sweet-sour preserves of fruit and vegetables) and their heath impact are released today by the International

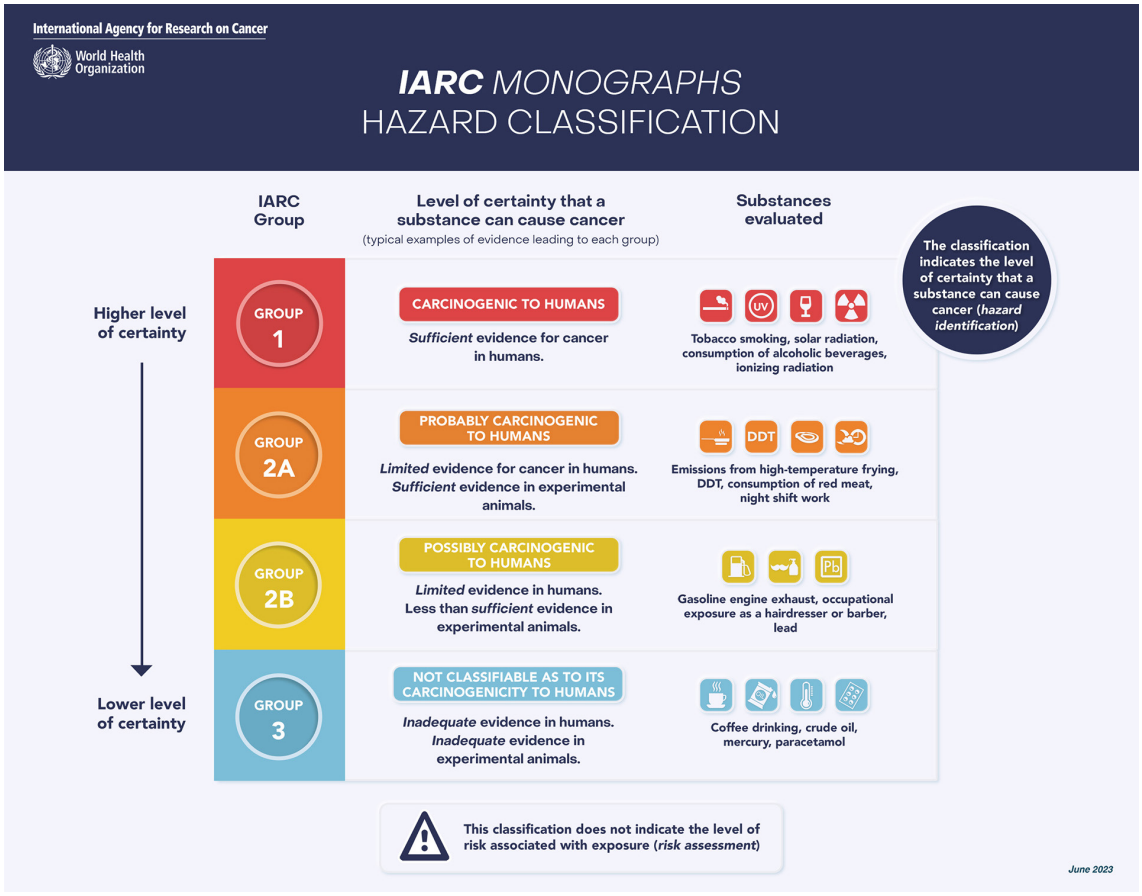


**Figure 2. IARC monographs hazard classification (ref. IARC).**

Agency for Research on Cancer (ref. IARC) and the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) Joint Expert Committee on Food Additives (ref. JECFA). Citing "limited evidence" for carcinogenicity in humans, IARC classified aspartame as possibly carcinogenic to humans (IARC Group 2B) and JECFA reaffirmed the acceptable daily intake of 40 mg/kg body weight.

The reassessment procedure for any additives or compounds by EFSA is lengthy and complex (ref. EFSA 5) and requires approval from the EU Commission when requested by specific stakeholders, typically industries or consumer associations.

## Beverages

### B1 non-alcoholic beverages (soft drinks and nervine drinks)

Since these beverages do not contain alcohol, they are suitable for young people and consumers seeking healthy, refreshing alternatives. Non-alcoholic beverages encompass a wide range of products, including natural fruit juices, carbonated soft drinks, flavoured waters, and sports drinks, all of which can hydrate, recharge energy, and provide a sweet or fruity flavour without the effects of alcohol. Coffee, tea, and chamomile tea are among the most popular nervine drinks, a category of non-alcoholic products that specifically influence the central nervous system. These drinks are generally considered stimulants and energizers, as they contain compounds that enhance nerve impulse transmission, increase alertness, and improve mood while relieving stress. Other examples of nervine drinks include infusions such as yerba mate and guarana, liquid chocolate, cola, and energy drinks (ref. ASSOBIBE 1)

### Sugar tax

The so-called sugar tax is implemented in many countries on sweetened beverages with an alcohol content of less than or equal to 1.2 percent by volume. This tax is intended to discourage the consumption of high-sugar drinks, encouraging consumers to make healthier choices and thereby reducing the risk of obesity and diabetes. Excessive sugar consumption leads to increased public

healthcare spending due to the heightened demand on National Health Services for treating diseases associated with obesity and diabetes.

The application of this law is still under discussion in Germany, Spain, Brazil, Australia, Canada, Colombia, and Lithuania. In 2013, Denmark abolished it along with the FAT Tax. While the sugar tax is active in about 50 countries, its implementation in Italy has been postponed to 2025, despite having been approved in 2020.

The Association of Non-Alcoholic Beverage Manufacturers in Italy (ref. ASSOBIBE 2) estimated a 16% decline in sales due to the sugar tax, resulting in cuts to investments and jobs. Additionally, prices for consumers are expected to rise, as companies may pass at least part of the tax cost onto their products.

The agricultural entrepreneurs' organization Coldiretti (ref. COLDIRETTI) has also intervened against the sugar tax, describing it in a statement as a "distorting measure that penalizes businesses and families, damaging the Made in Italy agri-food supply chain." They argue that its introduction will raise product costs and decrease consumption, thereby automatically reducing their profits.

Let's discuss these points in detail, starting with the positive aspect: The predominant industrial advertising message focuses on the sugar content in beverages, aiming to convey a positive nutritional message that encourages limiting daily sugar intake (e.g., low-calorie drinks, zero sugar, and drinks without added sugar). Since young people represent the largest group of soft drink consumers, advertising is often specifically targeted toward them.

It is important to note that there is generally insufficient or unclear information available to consumers regarding the partial or total substitution of natural sugars in fruit-based drinks with additives (sweeteners). Since the sugar tax will also impact the category of "no calories, zero sugar drinks," which is currently experiencing significant market growth, producers are concerned about a potential decrease in their profits as a result. Additionally, some of these additives may pose health risks depending on their concentration and overall consumption. Therefore, we believe that more detailed information on labels and advertisements regarding these substances is necessary. One recommendation, as previously mentioned, is to specify sweeteners by name on labels rather than using E numbers, allowing consumers to be better informed about the contents.

Because of this, we encourage non-alcoholic beverage producers to prioritize consumer health while considering profit growth as a secondary objective.

### Alcoholic Beverages

According to the World Health Organization, ethyl alcohol is classified as a carcinogenic substance. This means there is no safe threshold, and therefore, as with any carcinogenic compound, advertising should not be permitted. Additionally, bottles containing alcohol should be labelled with the warning: "*this product could be dangerous for your health*".

Alcoholic beverages are classified according to their alcohol content as in Table 2.

Currently, the most widespread and almost universally accepted categories of alcoholic beverages are distillates, wine, and beer.

**B2.1 Distillates** (e.g., whisky, brandy, vodka): Determining exact real-world consumption and production levels is challenging. Advertising for products in this category should be more strictly regulated at the political level, and the negative health effects should be clearly communicated to consumers, especially young people.

**B2.2 Wine**: The estimated production for 2023 was around 221 million hectolitres. Wine consumption has historically been common in many European countries and is currently a component of meals in the Mediterranean diet. The presence of several natural antioxidant compounds (such as anthocyanins and resveratrol), primarily found in red wine, should not be used to downplay the risks associated with its relatively high alcohol content. Educational campaigns are essential to limit wine consumption to low quantities.

**B2.3 Beer**: Beer is recognized as the most consumed alcoholic beverage in the world, with an estimated production of around 192 billion hectolitres in 2023. Its lower alcohol content compared to wine may contribute to reduced overall alcohol consumption, potentially resulting in a lower negative health impact.

**B2.4 Techniques to Reduce or Remove Alcohol Content**: The recent development of de-alcoholised beer

**Table 2. Alcoholic Beverages.**

| | |
|---|---|
| **Fermented** (obtained by fermentation of fruit juices, cereals and tubers) | wine, beer, cider (alcohol from 4 to14%) |
| **Liquors** (from addiction to alcohol sweetened solutions with aromatic substances) | aperitifs o digestive beverages (alcohol content from 15 to 30%) |
| **Distilled** (by fermentation and subsequent distillation (from fruit juices, cereals and tubers) | brandy, cognac, grappa, rum, vodka, gin, whisky (alcohol content from 30 to 70%) |

and wine products that maintain acceptable taste properties makes these no- or low-alcohol options attractive alternatives. The creation of dealcoholized products with pleasing flavour profiles is being pursued through pre-fermentative, fermentative, and post-fermentative techniques, depending on when they are applied in the process. The de-alcoholization of beer has essentially been perfected, while similar methods for wine are still being optimized, as preserving the aromatic profile after de-alcoholization has proven challenging.

A comprehensive analysis of procedures for wine, including dilution, blending, yeast selection, nanofiltration, vacuum distillation, and reverse osmosis, has been conducted by Gerbi (ref. Gerbi el al. V. IJFS vol: 36, n. 4, in press).

The WHO Action Plan for 2030 clearly outlines the associated issues and potential solutions. Alcohol is a toxic substance, and its consumption is well-known to cause numerous negative health effects. Despite this, alcohol consumption remains widespread globally. Alcohol is produced from various raw ingredients, depending on the availability of the basic carbohydrates (sugar or starch) used for production in the region.

Implementing strong formal restrictions on alcohol use, alongside policies to limit its availability (such as minimum age requirements for drinking or selling and increased taxes), would be beneficial.

## Dietetic products

Dietetic foods are defined as products that possess dietary properties and are intended for specific diets tailored to individuals in particular physiological or pathological conditions (ref. WHO 2).

### Art. 1 of the Italian D.L 27 January 1992, n. 111 states:

1. Foodstuffs intended for particular nutritional uses must adhere to the following criteria due to their specific composition or manufacturing process:
   a) they should be clearly distinguished from non-dieteic foods;
   b) they must be suitable only for specific nutritional objectives;
   c) they must be marketed in such a way that it will comply with the specific objective.

2. The foodstuffs mentioned in paragraph 1 must meet the particular nutritional needs of the following categories of individuals:
   a) persons whose assimilation process or metabolism is disturbed;
   b) persons who are in particular physiological conditions for which they may derive particular benefits from the controlled intake of certain substances in food;
   c) infants or young children in good health.

3. Only the foodstuffs referred to in paragraph 2, letters a) and b), may be labelled as "dietary".

   Notice that in the labelling, presentation and advertising of foodstuffs intended for everyday consumption, it shall be prohibited to use:

   a) the qualification "dietary" or "regimen" either alone or together with other terms;
   b) any other expression or any presentation that may lead to the belief that it is one of the products referred to in previous art. 1.

We recommend that health products, dietary products, and supplements be placed on clearly marked shelves to distinguish them from generic food products. Unfortunately, this is not always the case, which can create confusion and lead to incorrect purchasing choices. This is particularly true for foods dedicated to certain food intolerances. Food intolerances are reactions of the body to specific foods or food components. They occur when the body is unable to properly absorb or assimilate a substance, causing it to accumulate over time to a level at which symptoms appear. Food intolerances are disorders that mainly affect the digestive system, but whose symptoms can also manifest themselves as respiratory problems or rashes. The most frequent food intolerances are to lactose and gluten. (ref. EFSA6) In In this regard, we would like to make a critical observation related to the definitions proposed for some NON-dietary products, which provide information that we consider misleading regarding food intolerances. We refer in particular to the wording "gluten-free" or "lactose-free" added to products that naturally do not contain these components. Although this information may be beneficial for consumers who are not aware of the composition of products, it could be misleading and generate a sense of distrust towards products that contain gluten or lactose.

### Lactose free

Many products are naturally lactose-free (Table 3) and are often advertised as such. In our opinion, marketing a product that naturally contains no lactose as lactose-free or suggesting that lactose-free substitutes are a healthier choice compared to milk products for lactose-tolerant consumers is unethical. We do not agree with proposals to avoid the consumption of lactose-containing products for lactose-tolerant populations. Over time, this is likely

**Table 3. Naturaly Lactose-Free Foods.**

| Milk and cheese | Fruit and vegetables | Eggs | Bakery products and industrial foods |
|---|---|---|---|
| Gorgonzola | Broccoli | Fresh raw egg white | As per the label |
| Fontina | Spinach | Fresh raw egg yolk | |
| Sweet Provolone | Onions | Fresh raw whole egg | |
| Aged pecorino cheese | Coconut | Whole fried egg | |
| Parmesan Cheese | Pears | Whole egg omelette without cheese | |
| Grain | | Poached whole egg | |

to lead to an increase in lactose intolerance, especially if applied to children and adolescents.

## Gluten free

Recent epidemiological research shows an increasingly evident cause-and-effect relationship between the consumption of pasta that has become progressively lower in gluten over the past decades and the incidence of celiac disease (ref. MINISTRY OF HEALTH -IT1). No evidence has been reported on the variability of gluten content in "ancient" or recent wheat (ref. SILANO M).

By consuming gluten-containing foods, including pasta, it may be possible to reverse the course of this growing food intolerance and reduce its impact over the years. As described above for lactose-free products, we also believe that foods **naturally free** from gluten (Table 4**)** should not be labelled **gluten-free** since this could be misleading. We recommend that authorities and producers avoid using the gluten-free label on all traditional food products and reserve this label for dietetic food. While it may be useful for people less informed about food composition, there is a risk that the gluten-free label is being used to market gluten-free products as a healthier choice, even for those who do not suffer from celiac disease. This declaration can covertly suggest that the presence of these components is harmful, even for those who do not have intolerances, while they are **ONLY harmful** in cases of food intolerances.

Finally, we recommend that consumers carefully read labels when purchasing packaged products and that gluten-free products be placed on dedicated shelves in supermarkets.

## Food integrators

The Italian Ministry of Health (MINISTRY OF HEALTH - IT2) defines supplements as:

> "foodstuffs intended to supplement the common diet and which constitute a concentrated source of nutrients, such as vitamins and minerals, or of other

**Table 4.**

| Naturally gluten free food | Food with gluten | |
|---|---|---|
| Meat, fish, eggs, shellfish | Gluten-free cereals, flours and derivatives: | Cereals, flours and derivatives containing gluten |
| Milk and dairy products (fresh and aged cheeses, yoghurt) | *Rice* | *Wheat* |
| All types of vegetables | *Maize* | *Spelt* |
| Legumes (beans, broad beans, lentils, peas, soybeans, preparations with only legumes) | *Buckwheat* | *Barley* |
| Fresh and dried fruit of all kinds | *Cassava* | *Oats* |
| Coffee, tea, herbal teas | *Mile* | *Rye* |
| Alcohol | *Quinoa* | *Kamut* |
| Confectionery (honey, sugar, dextrose, sweeteners) | *Sorghum* | *All baked goods from flower of the above-mentioned cereals such as bread, pizza, biscuits, snacks, couscous, Bulgur, seitan, breakfast cereals etc* |
| Fats (butter, lard, lard, vegetable oils, margarines) | *Teff* | |
| Spices and condiments (balsamic vinegar, not fresh brewer's yeast, pepper, saffron, various spices) | | |

substances having a nutritional or physiological effect, in particular, but not exclusively, amino acids, essential fatty acids, fibres and extracts of plant origin, both mono-compound and multi-compound, in pre-dosed forms"

Food supplements are usually presented in small units of consumption, such as capsules, tablets, sachets, and vials, and can contribute to well-being by optimizing the state of health or promoting the normal function of the body with the supply of nutrients or other substances with a nutritional or physiological effect. Marketing is subject to a label notification procedure with the Ministry of Health. Once this procedure has been completed, the products are included in a special list with a specific code, the details of which can be reported on the label itself.

This category of products is now widely used in everyday diet for several reasons, with many believing they are useful for complementing nutrition.

There is no scientific data supporting the benefits of food supplements, yet Italians spend nearly 5 billion euros to purchase them. Additionally, there is excessive advertising that improperly promotes food supplements.

It is important to remind always that integrators (classified in Italy also inside the list of "medical devices") must not be confused with Drugs.

According to the WHO definition, a drug is a substance capable of influencing the physiological or pathological processes of a living organism. Drugs can be natural (animal, vegetable, mineral), semi-synthetic (radicals are inserted into natural products) or synthetic. They can be used:

- as a replacement treatment (e.g. insulin)
- as preventive (e.g. vaccines)
- to combat the causes of diseases (e.g. antibiotic, antibacterial, antiviral)
- to correct symptoms of a disease (e.g. anti-inflammatory)

On the contrary, some integrators (also classified in Italy as "medical devices") (ref. MEDICAL DEVICES 1) are products which does not exert in or on the human body the principal action for which it is intended by pharmacological, immunological or metabolic means, but whose function may be assisted by such means -refer to Regulation (EU) 2017/745 for the complete definition (ref. MEDICAL DEVICES 2).

These supplements are only a "tool" for prevention and/or treatment that does not interact with human metabolism; they are completely different from any medicine or paramedicine. For this reason, we suggest that the role of these supplements should be **CLEARLY** highlighted on the label. Moreover, there is criticism regarding how these devices are presented to consumers or advertised in the media, as they can often be **MISTAKENLY PERCEIVED AS DRUGS** due to the very small font alerts ("is a medical device") on the packaging or their appearance in the media for a duration too brief to be read and understood.

## Carcinogens

It is important to emphasize that many carcinogenic agents exist outside of industrial food preparations and, therefore, outside the topics covered in this opinion paper. However, they are mentioned here for the sake of completeness.

### Polycyclic aromatic compounds (PAHs)

**Polycyclic aromatic hydrocarbons (PAHs) are food contaminants whose presence in foodstuffs** is particularly concerning due to their carcinogenic properties (ref. SAMPAIO). These substances are highly lipophilic, and unsafe levels of these compounds have been found in edible fats and oils.

Several PAHs have been classified by the IARC as "probable" or "possible carcinogens for humans", benzo(a)pyrene has recently (2008) been reclassified in group 1 as *"carcinogenic to humans" (see previous* Figure 1).

Benzopyrene forms during cooking when food is in direct contact with fire: the molten fat burns upon contact with the heat source, undergoes pyrolysis, and produces this carcinogenic substance. The smoking process also generates benzopyrene, which can then be absorbed by food through the smoke and ultimately enter our bodies. The formation of benzopyrene depends on the fat content of the meat, cooking time, and temperature. Grilling can be done occasionally, provided that the fat does not burn. "*Benzopyrene levels can be reduced*" by avoiding direct contact of the food with the flame, cooking meat at lower temperatures for longer periods, and using meat with a low fat content. Food industries are strictly required to always follow HACCP procedures to completely avoid the presence of benzopyrene in their preparations. Using appropriate cooking methods is therefore essential for our health and to preserve the benefits that nature offers us.

### Smoke cigarette, elecronic cigarettes, cigars etc.

Smoke is a risk factor for 27 diseases and also contributes to air and water contamination through the emission

of various carcinogenic, inflammatory, and irritating components.

Throughout the day, we are constantly, and sometimes voluntarily, exposed to substances that are potentially harmful to our bodies, particularly those present in the air we breathe;

In particular, the use of electronic cigarettes—devices that deliver vapor containing flavours and/or nicotine—has increased rapidly both nationally and globally. Perceived and marketed as a "healthier alternative" to conventional cigarettes, there is limited data regarding the safety of these devices and their efficacy in harm reduction and treatment of tobacco dependence; even less is known about their overall impact on population health.

Due to the complexity of the issue, the dangers associated with smoking will be the subject of another specific publication in the future.

### Acrylamide

Acrylamide is a substance that can form naturally during the cooking of starchy products containing sugar and the amino acid asparagine, such as potatoes, cereals, coffee, bread, pizza, biscuits, and rusks. It develops when cooking occurs at temperatures above 120 degrees Celsius, as happens during frying, baking, and grilling. Potatoes, which contain asparagine at levels 100 times higher than wheat flour, are particularly prone to developing significant amounts of acrylamide.

Acrylamide is a genotoxic and carcinogenic substance, meaning it can cause mutations in our DNA, thereby increasing the risk of cancer. In 2015, EFSA stated that although there is no safe dose, it is possible to establish a dose with negligible effect. For a 60 kg person, taking into account the margin of exposure, this is equivalent to one microgram per day of acrylamide, which can be found in 1 g of potato chips, 3 g of fried potatoes, or 4 g of biscuits. EFSA's final opinion is of great concern: everyone in Europe is exposed, and children, due to the widespread consumption of risky foods (such as French fries, biscuits, bread, rusks, and crackers) and their lower body weight, are exposed to this substance at levels up to 10 times higher than adults.

**It is possible to monitor and avoid** the formation of acrylamide during cooking. To achieve this, it is essential to follow specific precautions regarding cooking methods, times, and the choice of raw materials. The acrylamide content tends to be higher when the food develops a darker colour after cooking. Among the main foods implicated are the dark edges of pizza, well-baked bread, and breakfast cereals. In a Conference held at the Academy of Georgofili in Florence on march 2023 a strategy for mitigating acrylamide formation in neapolitan pizza was discussed (ref. ACRYLAMIDE), with the aim to identify the best cooking methods for pizza. This research indicated how to monitor and prevent the formation of acrylamide in food, revealing that the content of this carcinogenic molecule is proportional to the colour of the products. It also identified specific conditions related to recipes, preparation, and cooking that could significantly reduce its formation.

## Micotoxins

Mycotoxins (ref. EFSA 7): "*are toxic compounds naturally produced by various types of fungi. Mycotoxins enter the food chain as a result of a crop infection that occurred before or after harvest and are usually found in foods such as cereals, nuts, nuts and spices. The presence of mycotoxins in food and feed can produce harmful effects on human and animal health ranging from simple gastrointestinal disorders to kidney problems, immunodeficiency and cancer.*

*Exposure to mycotoxins can occur through the consumption of contaminated food or animals fed contaminated feed. The mycotoxins that most commonly pose a concern to human and animal health are aflatoxins, ochratoxin A, and Fusarium toxins such as deoxynivalenol.*

*Since temperature and humidity are important parameters for fungal multiplication, climate change is expected to have an impact on the presence of mycotoxins.*"

Food industries must always carefully follow HACCP procedures to completely avoid the presence of benzopyrene in their preparations. An interesting and thorough discussion on mycotoxins is available in the related 2023 Accademia dei Georgofili FOCUS (ref. MICOTOXIN).

## Diets

### Mediterranean Diet

The Mediterranean diet primarily consists of vegetables and fruits, olive oil, legumes, bread, pasta, and other cereals, along with a few essential foods of animal origin. Historically, this diet was common among low-income populations, but today it tends to be favoured by individuals with higher levels of education, which often correlates with greater cultural and economic means that enable healthier food choices. Unfortunately, there are

increasing concerns regarding the eating choices and habits of younger people:

- A high daily consumption of sweets and sugary drinks concerns a non-negligible share of adolescents
- In Italy, adolescents show poor adherence to nutritional recommendations. There is, in particular, an emerging deficiency of iron and an excess of energy from fats at the expense of that taken from carbohydrates
- There is also a widespread habit of skipping breakfast, especially by girls and older adolescents

### Vegan diet

Veganism is the practice of abstaining from the use of animal products, particularly in diet, and encompasses a philosophy that rejects the commodity status of animals. A person who practices veganism (commonly called a "vegan") may do so to reduce animal deaths, minimize animal suffering, lower their ecological footprint, or for health benefits. In contrast, vegetarianism rejects the consumption of meat but allows the intake of other animal products, such as milk, dairy products, and eggs.

The vegan diet, while rich in vital nutrients, has clear deficiencies in certain vitamins, key minerals, and essential amino acids. Therefore, followers may need to use supplements (see C3).

Veganism, primarily based on a philosophical rejection of all animal products, must also take care to avoid supplements derived from or containing molecules extracted from animals. Additionally, babies breastfed by women who follow a vegan diet are particularly at risk of vitamin B12 deficiency within a few months of birth, which can have severe consequences for physical and neurological development (MINISTRY OF HEALTH [IT1]). However, excessive intake of vitamin B12 may increase the growth of neoplastic cells. Furthermore, vegans are more prone to fractures compared to vegetarians. Vegans also exhibit higher mortality rates compared to vegetarians who consume animal proteins from eggs, dairy products, or fish.

## Processed and ultra-processed foods (UPF)

In recent years, a terminology that improperly and incorrectly classifies foods according to the degree of processing has become increasingly popular.

This terminology, with the definition of ultraprocessed food provided by the NOVA classification (ref. MONTEIRO et al., 2019; ref. NOVA -1), divides foods into four groups based on increasing levels of processing:

- Group 1: unprocessed or minimally processed foods (essentially foods subjected to physical processing, cutting, drying etc.).
- Group 2: processed culinary ingredients (include oils, butter, lard, sugar and salt).
- Group 3: processed food: products made by adding salt, oil, sugar or other group 2 ingredients to group 1 foods, using preservation methods such as canning and bottling.
- Group 4: ultraprocessed foods (recognized as a wide range of products characterized by distinctive traits: typically produced by the industry, with substantial modifications to food structure, the use of additives and flavourings, and hyperpalatability, e.g., sweet drinks, ready-to-eat meals, snacks, breakfast cereals. Ingredients often include sugar, oils or fats, and salt).

Although this classification system was designed with the good intention of guiding consumers toward healthier food choices, it presents some conceptual inconsistencies/inappropriateness/limitations:

> In fact, first of all, this classification system does not take into account that food processing is essential for ensuring healthy and safe food (e.g., filtration, pasteurization, extrusion cooking, etc.). Secondly, foods processed with intense treatments are categorized in more favourable groups than those that are mildly processed, and vice versa. For example, seed oils (culinary ingredients – Group 2), which are obtained through solvent extraction and refining processes (e.g., neutralization, degumming, deodorization), are considered less processed than foods produced by extrusion cooking (Group 4). Extrusion cooking is a high-temperature, short-time process that is a versatile, efficient technology capable of preserving the nutritional quality of raw materials. Finally, the "process" appears to be a marginal factor compared to other elements implicated in health studies and relationships (formulations, ingredients, nutrient profiling, composition, and non-nutrient compounds).

Therefore, it is believed that the NOVA terminology, based on the "process" criterion (ref. NOVA -2), is inadequate for defining the relationship with health. Technological innovation and the adoption of mild, dedicated, or combined processes aim to enhance positive aspects (nutritional value, safety, sensory acceptability) while simultaneously reducing negative effects, such as technological damage (loss of nutrients and the development of undesired neoformation substances). The emphasis on palatability, appearance, and ease of food consumption ("food addiction") is not attributable to the

process itself, but rather to the choices of ingredients and formulations.

The passive acceptance of the current classification of processed and ultraprocessed foods, which assigns a negative connotation to processing, fails to recognize its ability to meet the nutritional and dietary needs of the population (in terms of digestibility, nutrient bioavailability, sensory acceptability, consistency, food safety, and the development of new products with high dietary-functional value, as well as the reduction of anti-nutrient substances). This perspective could be very detrimental to food safety, nutritional adequacy, consumer health, and research and technological innovation.

In our view, it is important to avoid misinterpretations and the adoption of nutritional strategies and policies that misrepresent the true meaning of the term "process." To this end, we suggest that stakeholders refrain from using, or at least critically reconsider, the current terminology and NOVA classification based on processed and ultraprocessed foods (ref. UPF).

## Novel Food

Under EU regulations (ref. NOVEL) "any food that was not consumed "significantly" prior to May 1997 is considered to be a novel food. The category covers new foods, food from new sources, new substances used in food as well as new ways and technologies for producing food. Examples include oil rich in omega-3 fatty acids from krill as a new source of food, edible insects, or plant sterols as a new substance or nanotechnology as a new way of producing food.

Traditional food is a subset of novel food and refers to food that is traditionally consumed anywhere outside Europe."

### Insects

Human consumption of insects and insect derivatives is widespread across the world except in in Europe where consumption almost absent as clearly shown in Tables 5 and 6.

European regulations regarding the consumption of insects for food are quite clear and restrictive: insects fall within the definition of "Novel Food" (ref. NOVEL), meaning that significant consumption within the European Union cannot be demonstrated for these products and substances.

The regulation dates back to 1997, but a report was recently approved by the European Parliament that

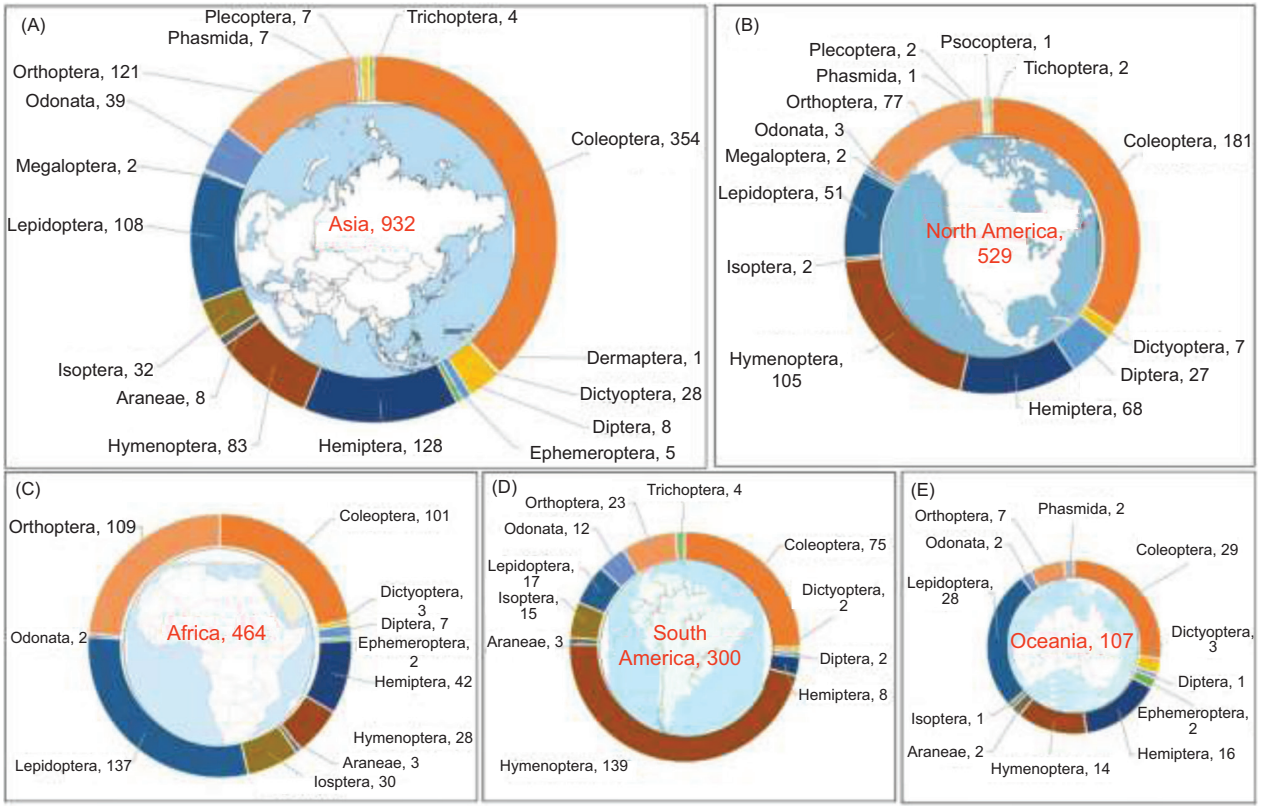


**Figure 3. Number of edible insects per Continent ( ref. INSECT).**

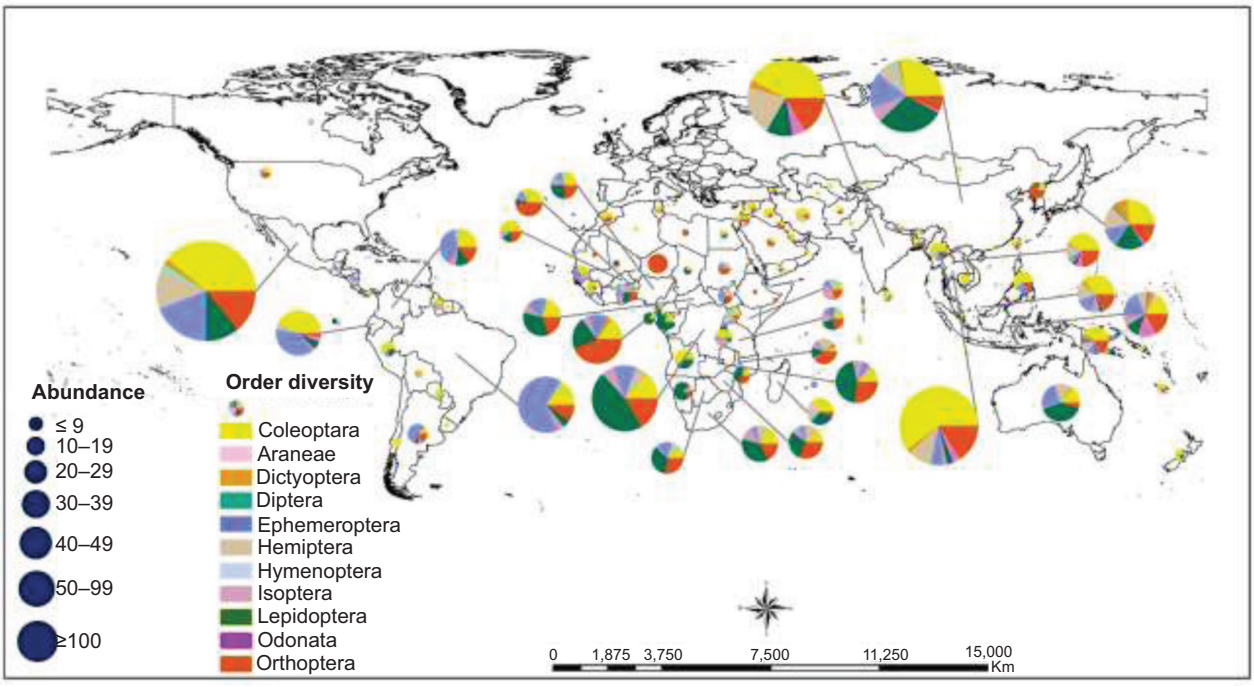


**Figure 4. Fig. 4 Global world distribution of edible insects ( ref. INSECT).**

simplifies the authorization procedures for Novel Foods. This text will need to be voted on by the Council. The new EU regulation, which has been anticipated for many years, will clarify the issue.

However, some EU member states have interpreted Regulation (EC) 258/97 differently and have excluded insects from the definition of "Novel Food" after conducting risk assessments that allow their distribution within their territories. Examples include the Netherlands and Belgium, where insect-based products have been available for sale in supermarkets for some time.

Last October, the European Food Safety Authority (ref. EFSA 5) issued an Opinion in which experts highlighted that the potential occurrence of microbiological hazards is predictably similar to that associated with other sources of unprocessed protein, provided that insects are fed with currently authorized feed substances.

### Cultivated meat

M. Post (ref. CULTIVATED MEAT 1) has published several papers on cultivated meat (CM), stating that it is a promising yet complex technology aimed at addressing the negative externalities of livestock agriculture. However, the technology raises ethical and religious dilemmas that require solutions through modifications to the technology or more advanced public and scholarly debate.

The European Commission has decided that the recently approved Italian law on "cultured meat" from stem cells cannot be implemented. Beyond political considerations, this decision presents an opportunity to turn the page and initiate a serious public discussion on an issue as sensitive as the future of food and its implications for our agri-food system and the environment.

In this context, the Ethics Committee of the Veronesi Foundation (ref. CULTIVATED MEAT 2) declares *"we are working on two new documents, both focused on the theme of food in the near future. The first will be an Opinion dedicated to the breeding and consumption of insects for food purposes. The second will be, on the other hand, a short statement aimed at reaffirming and updating the position of the Ethics Committee on the issue of meat from cell cultures. As with all the documents of the Ethics Committee, in both cases we will start first of all from the current state of scientific knowledge, without prejudice in one direction or another. The choices that await us are many, important and difficult. For this reason, the stupidest thing we can do is to blindly rely on ideologies instead of what science tells us"*

## Proposals, Recommendations and Conclusions

As stated in the introduction, our aim was to highlight some of the issues related to food labelling and advertising that are often silenced or neglected. Many of these

issues can harm consumers and, ultimately, human health in general.

Laws, even if well-designed, may not be sufficient to prevent health risks, as misunderstandings, fraud, and adulteration can still occur. It is essential to enforce laws and regulations through specific, continuous, and careful oversight. We believe that anyone involved in the production and marketing sectors of these industries (i.e., Food Technologist, Chemists, Biologist, MD, Economists, etc) must ensure compliance with the fundamental principle underlying their responsibilities: the health and safety of the consumer.

Labelling of products must be clear and straightforward in explaining their content. As outlined above, in addition to providing basic product information, labels should clearly and transparently convey "WHY" consumers should buy the product, presenting it in an ethically sound manner. With this in mind, national and European governments should carefully consider the recent claims made by the Georgofili Academy to the EU and the Italian Ministry of Agriculture regarding food labels (FOP LABELS), as these claims indirectly support our suggestions:

The Georgofili Claim (ref. FOP LABELS) stated:

> "*Food education is one of the most important tools to allow the consumer, taking into account his individual situation, to make choices that are more respectful of health and the environment. Any label can certainly not replace the educational task delegated to the institutions, but must support and implement it by providing the necessary information for the choice.*
>
> *In fact, every label (traditional or front) can be useful for consumers, especially for the less informed and poorly educated, provided that it involves clear, usable, objective and non-misleading information that teaches the consumer the concept of portion and helps him to make appropriate and informed choices, without simplistically delegating the choice to a visual impression of an instinctive nature.*
>
> *However, this labelling can only minimally solve the problem of insufficient food education, for which we need to develop a global European strategy that includes information and training campaigns from primary school.*
>
> *The issue of health and healthy lifestyles must be part of the overall education of European citizens.*
>
> *To achieve the objectives of combating overweight and metabolic diseases, the Union must not only put in place a purely regulatory approach within a single policy but leverage all competing policies (health, education, industry, internal market, agriculture, consumer protection and international trade) and also provide for ad hoc European funding to increase the risk of increasing the risk of obesity.*"

We recognize that health education is not currently a part of the curriculum in Italian schools. It would be beneficial to introduce at least one hour of lessons per week taught by qualified educators, starting from early childhood education and continuing through to university, using appropriate language. Additionally, Italy lacks a Superior School of Health, which would be crucial for the leaders of the National Health Service to enhance focus on prevention as a means to control the growing market for medicine.

In summary, we wish to emphasize the following recommendations to the industries involved in the production and advertising of food and health-related products:

- Additives in food products must be listed on labels by the additive name, NOT by its E Number.
- Beverages with a low or zero content of natural sugars must clearly state the substitute edulcorate list.
- Avoid indications such as "gluten free", "lactose free" or similar, on product NATURALLY exempt of them. Use these specific labels only on dietetic products that should be placed on separate shelves in supermarkets.
- Clearly indicate on the label the real role of integrators/medical devices to distinguish them from medicinal products.

We are convinced that if these recommendations are widely implemented, consumers will be better informed about what they are buying, eating, or drinking and how it affects their health. Furthermore, this will enhance consumer trust without significantly decreasing profits.

Finally, we hope that the additional case studies discussed in the last part of this paper (UPF and Novel Food) will be approached and evaluated more openly by national and European regulatory bodies, providing consumers with clarity based on scientific knowledge.

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## Author Contributions

The authors contributed equally to this article.

## Conflicts of Interest

The authors declare no conflict of interest.

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