Department of Business and Management

Master in Management

Chair Advanced Marketing Management

Implementation of NutrInform Battery system, the Italian answer to guide towards a healthier choice: a quantitative analysis with Multiple Traffic Light FOP label

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ADEMIC YEAR 2019/2020

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Introduction

Food: “Substance that, introduced into the animal organism, compensates for its energy expenditure, provides the reintegration materials, those necessary for possible growth and those elements (vitamins, minerals, etc..) essential for the normal performance of fundamental functions for the individual and the species”[1].

To quote an iconic scene from the famous movie "Dead Poets Society" of 1989 in which Robbie Williams acts: "Medicine, law, economics and engineering are noble professions, necessary for our livelihood. But poetry, beauty, romance, love, these are the things that keep us alive". Well, I believe that the only problem with the definition just mentioned, although it was very precise, is the fact that food is not and cannot be only sustenance to live. For us, Italians in particular, it is something deeper, something that is part of our culture and our history. So in a way, food can be like medicine, economics and engineering, and in this it would become a vital livelihood, but at the same time food is poetry, beauty, romance and love, so what colours our lives.

Although we often dwell too much on the idea that in Italy we eat well, in reality it is not only that. As in successful companies, in fact, there is not only a good product (in our case food), to make a company great, there are the people, the corporate culture, the marketing department, finance, etc. So even for us, when we talk about food, we actually mean a much broader concept. There is the food prepared, but we also approach it to a good company, to carry on traditions (for example at Christmas or Easter some dishes are prepared rather than others) and above all, all this is a symptom of conviviality for us. And as much as this may seem a stereotype, it is actually an important foundation of our being.

Over the years, I have had the fortune to travel and discover different cultures around the world, not surprisingly it is always said that to understand a people you also have to eat like them, and this has allowed me to get a general idea of how important traditions are, and to quote the French politician and gastronome Anthelme Brillat-Savarin: "*The*

[1] http://www.treccani.it/enciclopedia/alimento/

discovery of a new dish is more precious to mankind than the discovery of a new star". Above all the lifestyle they lead to shape these traditions according to their needs. And although the concept behind the word tradition implies a permeation of time, it is not the same for the word habits.

So for these reasons I became more and more passionate about food, so that I could travel not only with my eyes but also with taste and always try to assimilate as many cultures as possible.
I think, however, is important to clarify a concept, food is potentially something wonderful, but if not well used, like everything else, it can become harmful to our health. For this reason I decided to undertake this study, understanding that the factors that determine a bad diet can be among the most varied and therefore it is not an easy task to outline guidelines to follow for everyone, also and above all because each country has its own problems and needs.

We must take into account that we all live in a world with strong changes, and unfortunately in this world there is not always enough space for traditions and values of years ago. Habits, in fact, change, but also and above all changing the needs of people. The rhythms of work have changed, the time spent with family, the way of communicating with people also. Precisely in relation to this, also, eating habits are and continue to change, unfortunately not always for the better. In fact, I have decided to discuss in this study how dietary trends are changing over the decades, and also analyze the consequences of these changes. In fact, it is, unfortunately, evident that in the world the cases of eating disorders and diseases resulting from poor nutrition are clearly increasing. In fact, it will not be a novelty for many to hear about widespread obesity, eating disorders and health problems resulting from nutrition such as diabetes and cardiovascular problems, unfortunately it will not be a novelty to hear about all this even referring to younger people. These changes derive from different socio-economic and cultural factors in each country, each one of which can vary from the other in an important way, but for years we have been trying to outline as general a picture as possible so that we can also draw guidelines that can benefit all countries that need them.

And currently, these guidelines that are bringing more results in the battle against bad nutrition are called Front-of-packages (FOP). FOPs are information labels that are placed

on the front of food packaging and their purpose is to inform consumers about the degree of nutrition of the product they want to buy, they summarize the nutritional qualities that the product has, using different methods of communication (infographic, logos, percentages, etc.). This study in fact aims to analyze the most common in circulation to give a general idea. But the analysis will focus more on one of the last approved FOP, coming from our country and called NutrInform Battery, which aims to become the FOP more explanatory, and therefore useful for consumers, of the landscape of these labels. All this by comparing it with one of the other major FOPs in circulation, the Multiple Traffic Light.

Chapter I

1.1 Nutrition Trends in the world

This first chapter aims at giving a first overview of the state of the art regarding obesity and mortality trends in the world and at explaining the commitment that institutions have to fight the phenomenon (with a focus on WHO and FAO). Finally, the ultimate objective is to introduce FOP Labels system, which will be better described in the next chapter, and the current debate between Italy, against France and the UK with their current FOP Labels (Nutri-Score and Multiple Traffic Light).

Indeed, given the importance of the phenomenon, in order to better understand the purpose of this analysis, it is necessary to first give a picture of the health conditions that currently characterize our society, both at global and European level. It is, in fact, crucial to read the trends well, as they tell that, unfortunately, health problems due to poor nutrition are increasing and something needs to be done about them.

Another relevant aspect is to communicate the commitment that the many global organizations have to the issue of nutrition and thus to support the view that nutrition is a major problem both from a health point of view and from the point of view of public economy.

Finally, to conclude the chapter, it is important to report on the ongoing debate on the standardization of FOP labels at European level and how our country is at the forefront in advancing its proposal for FOP (NutrInform Battery system).

Unfortunately, the issue of malnutrition is too often taken into account only too little by the media, which tend to associate it only with developing countries. On the contrary malnutrition is a problem that affects all countries, in different ways. And above all we must consider the fact that it is an issue that tends to contain the interests of a great many stakeholders, first of consumers who are more involved, but also policy makers, scientists, producers and distributors, who could weigh on them certain choices.

1.1.1 Most common dietary diseases

It is relevant to remember how food, in various measures clearly, is not only vital for our lives, it also plays the role of social aggregator. It has always been a protagonist of all societies in the world, it is present in poetry, in art, the most crucial deals in history have been sanctioned by a banquet. Suffice it to say that most religious and non-religious feasts have a lunch or dinner as their protagonist. All this to say that food for all of us is a vital part of our lives, and from food we can learn many useful lessons for life, but unfortunately, although my praise wanted to elevate food, we must not forget that like all things if we abuse it, food can become a threat to our health. More and more people are suffering from obesity, which can be a threat if not treated properly.
That is why I have decided to present in the first paragraphs of this chapter the trends that are most significant on the subject of nutrition, initially with a global focus, and then I will concentrate on Europe.

This study begins from NCDs, also known as "Non Communicable Diseases", that are chronic diseases of long duration and are the result of "a combination of genetic, physiological, environmental and behavioural factors"[2], such as ischaemic heart disease, colorectal cancer, diabetes etc. The NCD has been analyzed since a long time in order to determine the main factors that contribute to the development of these diseases and prevent them (Willet and Stampfer 2013). Unfortunately, several attempts and also long-term randomized trials results to not been feasible to outline a synthesis of an epidemiological evidence. Anyway latest studies, with an alternative approach such as a long-term observational upcoming studies and short-term of intermediate results, have provided evidence of a probable connection between certain nutritional factors (vegetables, trans fat consumption, fruits etc.) and NCDs (Fund World Cancer Research; American Institute for Cancer 2018).

However, although during the last two decades great progress has been made in this field, given the great differences that exist between countries and cultures it is really difficult to outline an optimal and general diet consumption that can support the correspondence with health problems (Micha, et al. 2017). Unfortunately despite the great efforts made

[2] https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

in recent year, it is common opinion that these still are the major limitations for researches that persist: “a scarce geographically representative data on dietary consumption, inaccurate characterization of population distribution of dietary intake, insufficient accounting for biases of different sources of dietary assessment, standardization of the intake to 2000 kcal per day, and insufficient accounting for within-person variation of intake of dietary factors” (Collaborators GBD 2017 2019).
But in order to provide a picture as complete as possible, to overcome these limitations and provide reliable data, the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), from which it is drawn to provide these first data, has collected nutritional statistics from various sources, selected the population for more than 15 nutrients across 195 countries and assessed the result of each single nutritional cause on NCD mortality (Collaborators GBD 2017 2019).

“*You are what you eat*” was said by Doctor Feuerbach, food is culture, and just as culture tends to change, so did our behaviours change a lot during the last century. Eating habits and behaviours are determined by social, historical and technological factors, and during the last century we had to change our habits a lot, having lived through wars, an economic boom, a financial crisis and now a pandemic that will certainly change our working rhythms again. In fact, we have experienced a revolution not only by a technological point of view but also in the way we eat. A change that is not always positive, or at least not in all cases. In fact, in today's society we often find ourselves eating more and most of the time unnecessary thing than by actual nutritional need; and this, as we have often anticipated, this can lead to future health problems. In fact, it is easy to notice that during the years the time spent sitting at the table is decreased, this is due to the new working needs and the new structure of society (Scott and Vallen 2019). The demand for food that is easy to eat and easy to prepare has therefore become more and more widespread, to the detriment of more traditional meals. These new fast meals, however, do not always follow correct methods of preparation and attention to the raw material, moreover the demand for tasty food has led the market to produce food that is not always completely healthy.

In fact, it is been recorded that since 1990, the number of deaths attributable to dietary risks considerably increased to 11 million deaths and 255 million DALYs, “disability-

adjusted life year"[3], in 2017. The reasons that have mainly contributed to such exponential growth are mainly due to the increase in the population, the ageing of the people and a strong change in eating habits (Collaborators GBD 2017 2019).

In order to better clarify the trend of this situation, below it is been reported the data that better shows how needs to find a way to reverse this tendency. Worldwide intake of almost all healthy food and nutrients was suboptimal in 2017. The largest gaps between current and optimal intake were observed for milk, seeds and nuts and whole grains. With a consumption stands of 16% of milk per day, seeds and nuts at 12% per day, and 23% of whole grains per day below the optimal levels. On the other hand, daily intake of all unhealthy foods and nutrients exceeded the optimal level in every part of the globe. The consumption of sugar-sweetened beverages, 49 g of sugar per day, was higher than the optimal consumption. Worldwide consumption of sodium results 86% higher than the optimal amount, processed meat 90% higher than the optimal amount, and finally intake of red meat was 18% higher than the optimal amount (Collaborators GBD 2017 2019, 1959).

Based on these data, several studies have shown that more than half of all deaths due to dietary problems and about two thirds of DALYs are caused by an excessive sodium intake, for this reason were detected around 3 million deaths and 70 million of DALYs. Also were recorded that a low intake of cereals is responsible for a total of 3 million deaths and 70 million of DALYs, following by a suboptimal consumption of fruits, responsible for 3 million of deaths and 82 million of DALYs. Low cereal use is considered to be the biggest cause of DALYs for men, and the most influential for mortality rates among women. For what concerns men the first dietary risk factor is considered to be the overconsumption of sodium, followed by a low intake of fruits and whole grains. Finally, given the proven importance of cereals, they also represent the majority of risk factors for deaths and mortality rates among young people (25-50 years old) and, on the other hand, sodium is a threat to older people under 70 years of age.

In light of this situation, from the GBD study, it is possible to outline a state of the art of how much each NCD disease affects the total number of deaths, which we remember to

[3] It is a measure of the overall severity of an illness, expressed as the number of years death due to illness, disability or premature death

be 11 million and NCD disease impacts the total number of deaths and DALY. Of the total, the diseases that have the greatest impact on the total are cardiovascular problems. In fact, the causes of death and DALY for cardiovascular problems amount to 10 million of deaths and 207 million DALY, the second most common disease is cancer, counting victims for 913 thousand deaths and 20 million DALY. Finally, type 2 diabetes affects the total by a number equal to 33,871 deaths and 24 million DALY. For a total of about 5 million deaths of 177 million DALY, cases related to dietary problems are people under 70 years of age (Collaborators GBD 2017 2019, 1961).

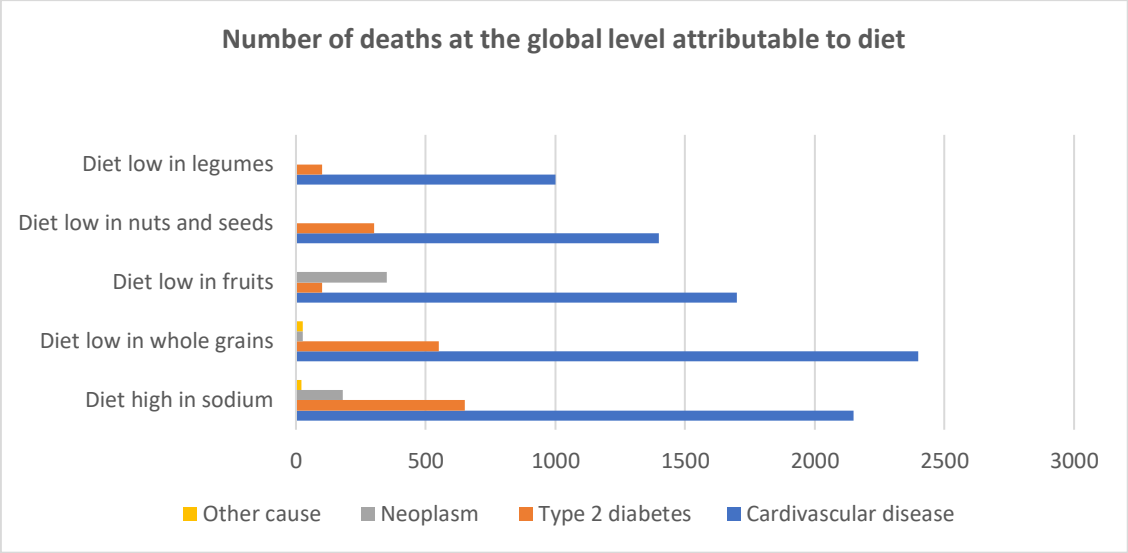

Figure 1: Number of deaths (per 100,000 population) attributable to individual dietary risks at the global level in 2017. Source: Collaborators GBD 2017, 2019.

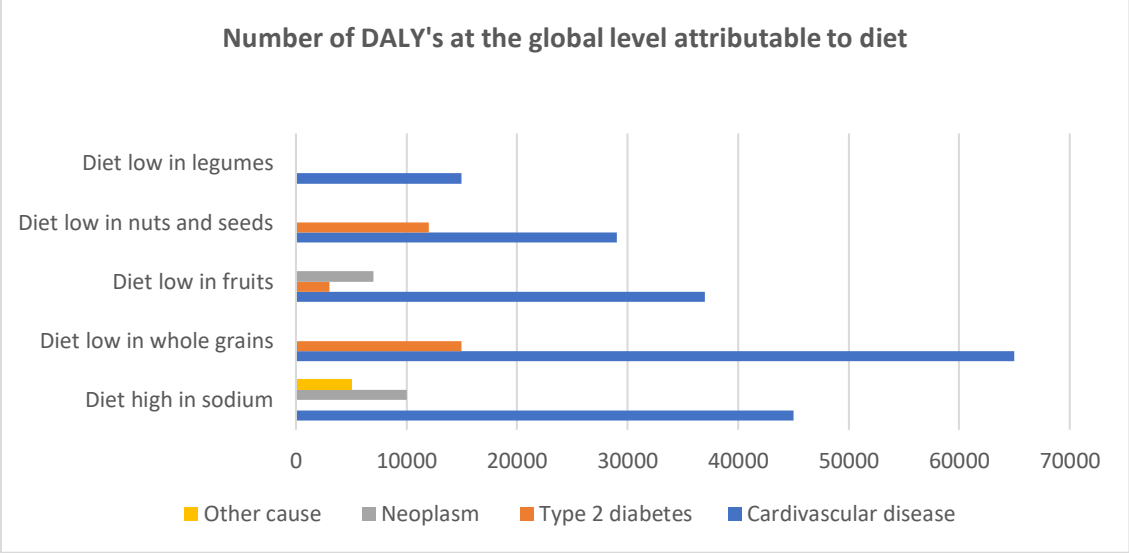

Figure 2: Number of DALYs (per 100,000 population) attributable to individual dietary risks at the global level in 2017. Source: Collaborators GBD 2017, 2019.

1.1.2 Virtuous and most affected countries worldwide

So far a general picture has been given, it is interesting to analyze more in detail the countries that are considered to be more respectful of the principles of healthy eating and to analyze also those that have more cases of diseases or problems, in order to deepen the analysis and give a more detailed picture of the situation.

Taking in consideration the entire globe, it is been discovered that the majority of the areas have an insufficient level of healthy food consumption. But still exist some exceptions in which the consumption of healthy food is not below the average. For example, in central Asia the consumption of vegetables is far beyond the average, also legumes in the Carribean, Latin America and south Asia and some part of Africa (such as Sub-Saharan Africa). It is also remarkable the consumption of seafood in high-income Pacific countries. On the other hand, data from the consumption of unhealthy food, such as sodium intake and sugar sweetened beverages, were far away from the average in every area worldwide. Also Australia and Southern Latin America are above the average for the consumption of red meat. High-income families from North America, Asia Pacific and western Europe have the highest processed meat consumption. Finally, the greatest concentration of trans fat consumption it is detected in North America and central Latin America.

As mentioned before the most common leading dietary risk factor and responsible for deaths, worldwide, is a diet with low intake of whole grains, and countries that are most affected are: USA, Brazil, Pakistan, Nigeria, Russia, Egypt, Germany, Iran and Turkey. Instead, a sodium-rich diet is the biggest cause of illness for the high-income areas of Asia (East Asia and Asia Pacific regions), China, Japan and Thailand. Southern sub-Saharan Africa and Bangladesh have a lack of fruit intake, and in central Latin America there is a lack of nuts and seeds consumption.

It is, also, important to analyze how, in the 20 most populous countries in the world, dietary risks materialize. For example, Egypt is the country with the highest number of deaths related to dietary problems (552 deaths per 100,000 population) and DALYs (10,525 per 100,000 population), on the other hand Japan is the country with the lowest number of deaths related to dietary problems (97 deaths per 100,000 population) and

DALYs (2,300 DALYs per population). Staying in Asia, China resulted to have the highest rate of diet-related cardiovascular disease deaths (299 per 100,000 population) and the highest rate of diet-related cancer deaths (42 per 100,000 population) and DALYs (889 per 100,000 population).

USA and Mexico resulted to have the highest rates of diet-related type 2 diabetes deaths and DALYs; in the USA the percentages of death and DALYs are respectively 41% and 50% while in Mexico are registered 35 death and 1,605 per 100,000 population. As mentioned before, Japan resulted to have the lowest rate of diet-related cardiovascular disease deaths and DALYs (69 deaths per 100,000 population and 1,507 DALYs per 100,000 population) and diabetes deaths and DALYs (1 death per 100,000 population and 234 DALYs per 100,000 population). Egypt had the lowest rate of diet-related cancer deaths and DALYs (5 deaths per 100,000 population and 120 DALYs per 100,000 population). The highest proportions of diet-related cardiovascular disease deaths and DALYs in 2017 were observed in Pakistan (60% of deaths and 66% of DALYs), cancer deaths and DALYs in China (16% of deaths and 15% of DALYs), and type 2 diabetes deaths and DALYs in the USA (41% of deaths and 50% of DALYs). The lowest proportions of cardiovascular disease deaths and DALYs were seen in Turkey (42% of deaths and 44% of DALYs).

A further important element that emerges from this study is the fact that the countries most affected by nutrition problems are the so-called low-middle SDI countries (SDI is a socio-demographic index that to compare countries' health outcomes and the performance of health systems, and better understand what tomorrow's health landscape will look like).
In fact, in 2017 low- middle SDI countries registered 344 deaths per 100,000 population and 7,797 DALYs per 100,000 population and on the other hand high-middle SDI countries registered 347 deaths per 100,000 population and 6,998 DALYs per 100,000 population. But the lowest exposure to diet-related risk was registered in high SDI countries 139 deaths per 100,000 population and 3,032 DALYs per 100,000 population. Low-middle SDI registered 311 deaths per 100,000 population and 6,685 DALYs per 100,000 population, that is the highest rate of diet-related deaths and DALYs for cardiovascular disease and diabetes. High-middle SDI registered 29 deaths per 100,000 population and 630 DALYs per 100,000 population, with the highest rates of diet-related

mortality for cancer. “The peak amounts of diet-related deaths and DALYs for all causes were observed in high-middle SDI countries 29% of deaths and 19% of DALYs, the lowest proportion of diet-related deaths was observed in low SDI countries 16% of deaths” (Collaborators GBD 2017 2019, 1967).

To conclude this first paragraph, is it possible to note that the emerging data reflect an unfortunately worsening trend. The curve of illnesses and deaths recorded is in fact a symptom of habits that are far from being healthy. It has been evidenced that in all countries is a lower than average consumption of food considered healthy as cereals and vegetables, while on the contrary sodium, red meat and sugar. Consumption is well above the average, no age category is excluded from children to adults; a breakthrough is needed, or the numbers could continue to increase disastrously.

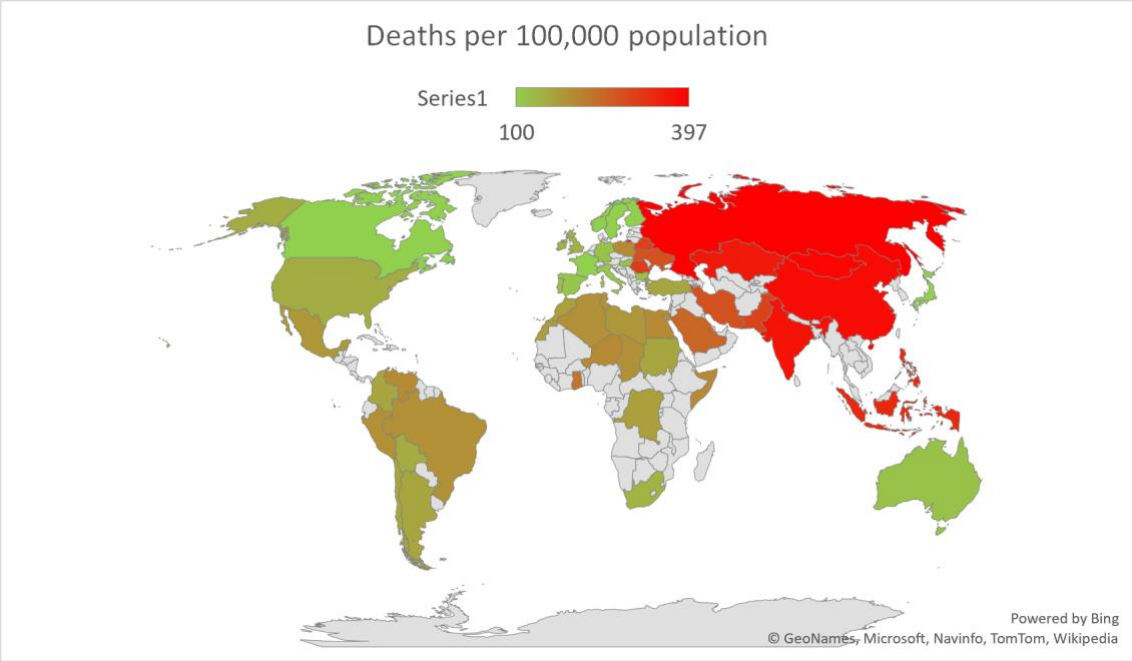

Figure 3: Age-standardised deaths per 100,000 population attributable to diet in 2017. Source: Collaborators GBD 2017, 2019.

1.1.3 Virtuous and most affected countries, a European focus

Until now, the main focus have been held on a global level. But it is equally important to have a closer look on Europe. In fact, from the various studies that have been carried out, mainly by the WHO, it is been find out that although European countries are not in high risk situations, they are not even exempt from the dangers of the NCDs we have talked about so far (World Health Organization 2018).

Since 2000s, the European Union has concentrated most of its efforts on implementing policies to reduce obesity in the countries of the Union and improve healthy food consumption habits. Since then, most Member States have adopted policies to educate their citizens about better eating habits. However, the Action Plan that was outlined during the 2000s must now be revised with new objectives and new policies to develop. In fact, Member States developed the European Food and Nutrition Action Plan 2015–2020, that includes state-of-the-art knowledge on the factors that influence dietary behaviour.

As we have repeated from the beginning, NCDs are the biggest cause of death in the world, and this trend is confirmed in Europe too, in fact in 2015 cardiovascular diseases, cancer, diabetes and respiratory disease, caused 89% of deaths in Europe, which means in percentage terms a 3% increase over the average in the 2000's when the action plan began. “Anyway the risk of death from one of the four main NCDs before the age of 70 is low in some countries (Switzerland 9%, Italy and Sweden 10%, France 11%, Germany 12%), the same risk is up to threefold higher in the eastern European region (Bulgaria 24%, Belarus 26%, Ukraine 28%, Russian Republic 30%). Differences in the prevalence of smoking and of obesity are two of the main explaining factors; however, differences in access to and the quality of medical care play a role as well”.[4]

In Europe, Members states have been trying to defeat the four main causes of NCDs, smoking, unhealthy diet, little sport and alcohol, for years now. In fact, it has been noted that there is a persistent trend in the years in which men sovereign a higher mortality rate than women, mainly in the states to the east of the EU. But at the same time women live

[4] https://www.escardio.org/Journals/E-Journal-of-Cardiology-Practice/Volume-15/Non-communicable-diseases-a-growing-threat-to-global-health

those extra years in poor health. It is for this reason that new policies to address this trend must take into account several factors, not only nutritional factors or good health in general, but also gender and socio-economic factors.

The analysis started from the assumption that NCDs have good chances to be related to the food that a person has had during his or her life, for example, as said before, there are several factors that can be explanatory of different disorders, such as high body-mass index (BMI), excess sodium or salt intake and low fruit and vegetable consumption. "The Global Burden of Disease Study shows the importance of an unhealthy diet and the risks associated with high BMI have increased significantly since previous analyses were performed"[5].

While it has been previously analyzed how globally the diet of some particular regions of the world was too abundant in certain elements, at the European level the diet is characterized by energy inequity and excessive consumption of saturated fats, salt and sugar, largely due to increased consumption of highly processed, energy-dense manufactured foods and sugar-sweetened beverages and inadequate consumption of vegetables, fruits and whole grains. At the beginning of this paragraph it has been introduced how today's society has changed, how habits, needs and even tastes have changed over time, and not always in the best way. In fact, today, it is much easier to find products with good taste but with the same caloric value on the market. This is the case, for example, of sugar-sweetened beverages. It is not a coincidence that many children and adolescents consume large quantities of sugar precisely because of the ingredients of these drinks, which have become increasingly common and easily accessible. However, this is not the only cause highlighted by the studies, in fact, among the causes are also reported factors not directly attributable to the choices of the child or adolescent, but also inadequate maternal nutrition (superfluous body weight before, during and after pregnancy), insufficient breastfeeding and wrong complementary feeding (World Health Organization 2018, 4).

[5] World Health Organization, Better food and nutrition in Europe: a progress report monitoring policy implementation in the WHO European Region, 2018

A study conducted by the WHO since the 2000s has shown that there is a general shortage of certain key nutrients in all states of the Union. The most striking example of this trend is represented by the fact that the WHO indicates as recommended daily consumption no more than 30% of total fat intake and no more than 10% of saturated fat, respectively these two values are not represented for the first limit in any country and in the second case almost all do not respect it. In addition to this, the 5% daily limit for sugars is not respected in all countries of the Union. The highest intakes are those of children and adolescents, whose consumption normally exceeds the 10% upper limit; sugar-sweetened beverages, cakes and breakfast cereals are the main sources.

"The prevalence of overweight and obesity in the WHO European Region has thus been increasing steadily, to alarming levels"[6] . From a research by WHO, has been estimated that 56.1% of the adult population of Europe was overweight in 2010, and the dominance had augmented to 58% in 2014. Another finding from this research was that men tend to be more overweight than women (62.5% versus 53.7%). The study, moreover, predicted a trend for 2025, starting from the basis of the study started in 2000, that almost half of the population of all Member States will be overweight or obese. This means that more and more people may have problems developing so-called NCDs.

Unfortunately, data do not only concern adults, but unfortunately there are some not entirely reassuring trends concerning children. The risks of developing NCDs do not only involve wrong choices made by adults, but also certain behaviours as children can not only have immediate results but also determine future events in their lives. "Promoting good maternal and early-life nutrition, preventing childhood obesity and supporting the development of healthy dietary preferences from an early age are therefore essential" (World Health Organization 2018).

In fact, European Childhood Obesity Surveillance Initiative (COSI) in 2014 highlighted that one in three children aged 6–9 years was overweight or obese, furthermore, the study showed that these data came especially from southern European countries and mainly from lower socio-economic classes (Ahrens, et al. 2014). A WHO report indicates that the rate of obesity in the younger ages has steadied in some countries, but unfortunately

[6] European Health for All family of databases. Copenhagen: World Health Organization Regional Office for Europe; 2016 (http://www.euro.who.int/en/data-and-evidence/ databases/european-health-for-all-database-hfa-db, accessed 11 November 2017).

more than half of the countries covered by the HBSC study have shown that this trend is growing since 2002, to be more precise, the highest increase was recorded in eastern European countries, where the rates of obesity were moderately low in 2002 (Inchley, et al. 2017).

The trends outlined so far, which represent the current global condition in terms of malnutrition and NCDs, are strongly taken into account by international institutions, but also by smaller organizations that have become reference points for entire continents. What will be highlighted in the following paragraphs is how this issue is one of the priorities of international governmental plans and how the issue of malnutrition should be considered a major priority, since, as will be seen, it not only has effects on people's health, but it has also economic implications.

1.2 The institutional Organizations and their Commitment

1.2.1 Economic Commitment and New Initiatives

While it is true that early mentioned trends may seem discouraging, on the other hand it must been taken into account that different organizations, at a global level, have been fighting problems for decades such as malnutrition. Probably, given the great awareness of the issue of food security and malnutrition, those are the fields in which some of the largest organizations in the world operate, mobilizing social consciousness and employing great amount of capital, both human and economic. It is significant how many of these organizations have become full-fledged institutions. Their recommendations are taken as a basis by policy makers to develop their action plans. As it has been said, there are many and different types of organizations; among the most relevant they can be found: international organizations (WHO, FAO, UNICEF, and World Bank), donor agencies (USAID, DFID, JICA, and CIDA), and global initiatives (SUN, GAIN, and MNI).

Certainly, in the field of malnutrition and food security the organizations that stand out most are WHO and FAO. Their contribution, which has continued unceasingly since the Second World War, has increased exponentially, during last decades, to deal with the increasing number of people who suffers from malnutrition (FSIN 2019).

FAO, Food and Agriculture Organization, is the oldest organization affiliated with the United Nations, starting aim was to support agricultural and nutrition research and providing technical support to member states to enhance agriculture. It joined the UN General Assembly and collaborated in establishing the UN World Food Programme, one of the largest humanitarian organization against hunger and supporting food security.

WHO is aimed, for all populations, at achieving the highest possible level of health, defined in the same constitution as a condition of complete physical, mental and social well-being, and not just the absence of disease or infirmity[7]. It is a member of the United Nations Development Group.

An important aspect that should be taken into account is the fact that they have always managed to create collaborative links with the largest institutions. One of the most recent examples of this is the case of FAO, which has been supported by the European Union. In fact, the EU has allocated 3.5 billion euro in their Multiannual Financial Framework 2014-2020, of which 2.49 billion euro has already been allocated to nutrition programs between 2014 and 2017. In addition to the actions taken directly in these areas, the EU has allocated 3.5 billion euro in the 2014-2020 Multiannual Plan.

Apart from that, EU is one of the greatest collaborator of UN programmes. For example, between 2007 and 2017, the EU provided more than 1.5 billion euro for more than 250 FAO-led programs in 60 countries, increasing support following the 2007-2008 food price crisis. A further agreement was signed with FAO last October to provide a €70 million grant to the Global Network against Food Crises, a program launched in 2016 to promote sustainable solutions to food crises (Riggio SJ 2019).

All this testifies to the importance of actions taken to fight malnutrition and implement food security, both locally and globally.

Among FAO's efforts, WHO has decided to structure its strategy based on the United Nations Decade of Action on Nutrition 2016-2025 that aims to eliminate all forms of malnutrition globally, to achieve the ultimate goal which is to ensure a healthier life and

[7] https://www.who.int/about/what-we-do

more sustainable diets for all people. Always following the of the Sustainable Development Goals (SDGs).

In order to achieve these objectives, the WHO has paid particular attention to encourage countries to adopt and implement their recommendations. For example by increasing marketing for healthy and non-alcoholic foods for children (World Health Organization 2010). The possibility of introducing fiscal measures on influence diets and finally increasing initiatives to reduce salt in products[8].

As if that were not enough, in addition to the measures just mentioned, the WHO has proposed to its member countries the following priorities to be respected in the European Food and Nutrition Action Plan 2015-2020, in which all member countries have agreed and accepted the following recommendations:

- Implement strong measures against mass marketing of high calories, saturated fats, trans fats and sugar foods for children.
- Consider economic measures, such as improving the product supply chain, tailor-made products taxes and subsidies, and promote healthier foods on a massive scale.
- Establish interorganizational collaboration in order to facilitate the dissemination of the culture of healthy food among schools, hospitals, public offices and institutions.
- Promote through official institutional channels the reformulation of products, improve the healthy appearance of products sold to the public and massively encourage the use of new forms of labelling, using more user-friendly forms, and develop and spread the use of the so-called Front of Pack labels.

Although the above points are four, the WHO intends to put further emphasis on two recommendations in particular: the use of FOP labels and the spread of culture for healthy food in schools. In fact, the focus is on this last one to which great effort is being committed. It has been shown that in Europe a good percentage of people with poor

[8] SHAKE the salt habit. The SHAKE technical package for salt reduction. Geneva: World Health Organization; 2016 (http://apps.who.int/iris/bitstre am/10665/250135/1/9789241511346-eng.pdf, accessed 80. 11 November 2017).

nutrition are children, so educating them from an early age could be a successful long-term strategy for their adult health.

Many initiatives will need to be stable in order to ensure that schools distribute healthier food and increasingly reduce the sale of HFSS products (products with high levels of fat, sugar and salt). In addition to this, subsidies would also be planned to provide schools with free fruit and vegetables and provide new nutrient-based food standards (Hawkes, et al. 2015).

"Evidence suggests that nutrition education is most effective if it involves learning skills, such as cooking or food product literacy, rather than just providing information" (Hoelscher, et al. 2013). However, although studies have proven the excellent results that the implementation of these policies would bring, additional variables must also be taken into account. In fact, a partial limitation of vending machines could limit the effects of these new policies, because children can still buy HFSS foods (Spence, et al. 2013). "The evidence therefore suggests that a comprehensive, multi-face approach will have more positive results" (Adamson, Spence, et al., School food standards in the UK: implementation and evaluation 2013).

As for the first aspect that it is been mentioned above, the WHO through the European Food and Nutrition Action Plan wants to encourage Member States to adopt labelling that is more understandable and faster for consumers to read. "Front-of-package labelling can facilitate consumer understanding of the nutritional content of many foods, especially complex processed foods, and might also affect their diets by encouraging food producers and retailers to reformulate their products or develop new ones". [9]

Some might argue that there are already informative labels with all the necessary information (also called "backs of packages"), but they would be difficult for many to read and understand (Campos, Doxey and Hammond 2011). "Front-of- package labels with interpretative information about nutrient content – explained with words, symbols and colours – have been found to be easiest for consumers to understand and interpret correctly" (J. Hersey, et al. 2013). As the last resort used by WHO on this strategy, it is stated that scientific evidence has shown that the use of FOP labels on products has been

[9] World Health Organization, Better food and nutrition in Europe: a progress report monitoring policy implementation in the WHO European Region, 2018

shown to be healthier for consumers who choose products with logos (E. Vyth, et al. 2010)

1.2.2 Could policy choices on nutrition have implications for the economy?

It is been visible since now, how resources employed in the malnutrition fight are relevant as well as the participation of the major institutional players. What is, perhaps, still not very clear, however, is how, in addition to one aspect from the point of view of people's health, nutrition policies can have huge effects on a country's economy. Taking up the four points recommended by WHO on the European Food and Nutrition Action Plan 2015-2020, it can be seen that there is also a recommendation aimed at economic interventions, going to work on supply chain, taxes and subsidies. It can be said that malnutrition has a cost for public health, to give an example all people who suffer from NCDs consequences are approximately 33 million patients in Europe, at an estimated cost of 170 billion dollars (Ljungqvist, et al. 2010). This is more than twice the amount of money spent on obesity, based on the UK situation (House of Commons Health Committee. 2004).

In the light of this data it is easier to understand why acting successfully on this aspect is crucial both from the point of view of people's health and from an economic point of view.
It is not a coincidence that in the last few years a discipline has been emerging that takes into account the choices related to food from an economic point of view, analyzing the cost-effectiveness of each choice, just as for any other political choice. This is allowing policy makers to have a further point of view able to quantify the economic effect of choices concerning public health, "in order to estimate the absolute and relative monetary impact of health measures"[10].

The introduction of this discipline was the response to the increasing weight of budget on public health. However, although at first there were doubts about the applicability in the real world, the principles of economic assessments are now well established. These

[10] Freijer, K. Nutrition Economics – An Introduction. ISPOR CONNECTIONS, 2010.

assessments calculate costs, savings and the health effect and compare this with possible alternatives. Anyway, to be clear, health economics is much more focused on health outcomes than money. The real big problem with affirmation of health economics was that initially most of the institutions did not consider it to be founded on a solid and scientific basis, able to give clear and concise indications., for example as is it written in a European Report: ". . . there is virtually no information on the cost-effectiveness of functional food, i.e. it is unclear at what cost the expected health benefits come. But after studies indicate that functional food may help prevent diseases that currently impose a heavy drain on health care budgets"[11] . But after scientific tests that have proven the correlation between nutrition and NCDs, policy makers has felt the necessity to realize the importance of food on health. "Consequently, economic evaluations of its effectiveness have been conducted on an increasing basis" (Genton, et al. 2005).

Surely the way forward actually is to improve the health of citizens by educating them in the art of healthy eating, through the implementation of the many recommendations made by the WHO. This improvement can directly contribute to cost-effectiveness and sustainability of health care systems, reducing the cases of patients from NCDs medical expenses for those patients will no longer affect medical expenses and those savings can be used for other medical needs. However, the doctor *Karen Freijer*, in order to provide reliable projetions, says: "Therefore, it is essential to describe and quantify the costs (both the immediate costs of the intervention and downstream consequences) and effectiveness of nutrition interventions, as well as to assess the impact for individuals, the health care system, and society as a whole"[12]. And for these guidelines to be created as soon as possible, expert groups have already been set up, such as the ISPOR Nutrition Economics Special Interest Group, which is already working to draft the first recommendations on economic assessments in this field.

To conclude, health economics, if properly implemented, can be a very valuable resource for the development of new policies in the field of nutrition and will allow policy makers to make more targeted and informed decisions.

[11] Functional Food in the European Union (2008) European Commission, Joint Research Centre, Institute for Prospective Technological Studies. http://ftp.jrc.es/EURdoc/JRC43851.pdf
[12] See note 8

1.2.3 From the establishment of FAO to Codex Alimentarius

In order to make it clearer how the introduction of FOP labels was achieved, it is necessary to clarify the development process of one of the most involved organizations in malnutrition together with WHO. This is called Codex Alimentarius, a special commission held by experts established by FAO. Its mission is to standardize guidelines on food strategies.

In fact, FAO and Codex Alimentarius Commission are two of the best known and most successful cooperative projects between United Nations agencies. FAO was founded in 1945 and in 1961 was founded the Codex Alimentarius.

The main aim of FAO at the beginning was protecting nation's food supply. The idea comes from the fact that, since the ancient world, protecting citizens from the issue of food was a developed duty, for example ancient Greeks used to control the purity of wine and beer. Or again in ancient Rome, there was a system of controlling the quality of products and to protect customers from frauds. And finally in Europe, during Middle Ages, there were different laws about quality and safety of most common food such as cheese, bread and meat.

But it was only during the second half of the past century that the first general food laws were established and the first structured food control systems was built up. The first aim of the organization was to set laws and standards in order to prevent contamination and to protect consumers against fraud. Anyway, at that time, food chemistry started to be accepted as a feasible method of determination of the "purity" of food. Food chemistry, in fact, became really important some years later, because was capable of determining posed when industrial chemicals were used to preserve food or to enhance taste.

Anyway the devastation of the Second World War, especially in Europe, was the reason why politicians and economists were convinced that agriculture enhancement through implementation of trade would be crucial to reconstruct society and to feed people.

FAO's first conference, the United Nations' Conference on Food and Agriculture, was convoked in 1943. The first problem that emerged was that for some countries, especially those considered to be developing countries, the standards chosen for trade could not fit.

This would have inevitably led to differences and would not have achieved the goal of healing the post-war nutrition problem. Therefore, it was decided to extend the assembly also to further figures in order to find solutions that would go well internationally, protecting trade through well-structured rules that would also protect citizens.

So in 1945 FAO was officially created and three years later, in 1948, the World Health Organization (WHO) was founded, so a series of institutional meetings with experts in the field of nutrition and related areas began[13].

In 1950 the first FAO/WHO meeting took place with the main theme of nutrition. What emerged mainly from the conference was the fact that among the states the food legislations were often very different and contradictory, in fact it is stated: “nomenclature and acceptable food standards often varies widely from country to country. New legislation not based on scientific knowledge is often introduced, and little account may be taken of nutritional principles in formulating regulations" (FAO, WHO 1950).

If, on the one hand, the international community had only mobilized itself after the war, the evolution has followed a different path if considered at a regional level. As anticipated before, the Codex Alimentarius as we know it is actually the result of smaller initiatives, in fact in Latin America, Carlos Grau supported the establishment of the Código Latino-Americano de Alimentos in Argentina. Another example is the *Codex Alimentarius Austriacus* pursued by Hans Frenzel, who in 1958 founded the Council of the Codex Alimentarius Europeus along with International Commission on Agricultural Industries and the International Bureau of Analytical Chemistry. Unfortunately, in agreement with Davies, the committee was unable to make progress with its objectives during those years (Davies 1970).

The First FAO Regional Conference for Europe, in Rome in October 1960, indicated as the main need to reach agreement among countries, at global level, on minimum standards to be respected in food and related issues such as labelling requirements, methods of analysis, etc. Also that “was recognized as an important means of protecting the consumer's health, of ensuring quality and of reducing trade barriers, particularly in the rapidly integrating market of Europe." (FAO 1960).

[13] http://www.fao.org/3/V7700T/v7700t09.htm

The main theme of the conference held in Geneva in 1962 was to officially establish the framework for collaboration between FAO/WHO on nutrition standards. In addition, the role of the Codex Alimentarius as the body responsible for implementing the FAO/WHO programme was further formalized. This first conference laid the groundwork for the first session of Codex in Rome in 1963.
In 1965, then, the Codex established the Regional Councils, so as to maintain, at least in part, the imprint given by the Council of Codex Alimentarius Europeaus. In addition, the Codex also modelled its objectives according to the specific needs of its member countries.

The Codex consists of 14 volumes, including 237 food standards, 37 good manufacturing and hygiene codes and much more. It is thanks to this great work that the Commission since the 1960s has managed to achieve almost all the tasks they had set themselves, and no other organization outside the Codex Commission has ever pretended to try to organize such a large work, making the Codex Commission a great success.

The establishment of Codex, as will be seen, has played a key role over the years in completing the objectives set by FAO and WHO.
Thanks to this ability to achieve the objectives, Codex has managed to gain credibility and becoming a reference point on issues such as malnutrition and health policies. Thanks to this, it will be seen, how Codex will be called to lead institutions towards the development of FOP labels.

1.3 The Codex Alimentarius

1.3.1 Mission

"Protect consumer health and promote fair practices in the food trade by setting international, science-based food safety and quality standards."[14].

The Codex, as it could be introduced before, was the result of a shared need to have a committee to ensure efficiency and transparency in the trade of food between states and

[14] Codex Alimentarius' mission

also to guarantee its quality and integrity. The establishment of such a commission has been the evolution of other Codex existing at regional level (for example the Austrian and Argentine Codex) and during the years has undergone great evolutions to the point of going back in time. to give an idea of how much the composition of the Commission has changed over the years, probably if the members of the Commission in the 1960s saw the current situation, they would not recognize for certain that this is the Codex Alimentarius they founded. In fact, the Commission's first training consisted of 30 countries, almost all of which were industrialized, while to date there are 151 countries, representing around 97% of the world's population, with at least 350 members attending each session, representing around 70 countries. This testifies to the fact that the Commission has been able to develop and act as a guarantor for almost all the countries in the world, which is no small achievement.

The need to have such a commission in the first place relies on the fact that international trade in food and goods has existed for centuries, it is one of the foundations of social development in antiquity, but at least until before the last century most of the food produced and consumed took place locally. On the contrary, in the last century, international trade of food and goods has experienced a more than exponential growth[15]. Actually international food trade is one of the greatest market, recording a value of 2,000 billion dollar per year, the quantity of food produced, traded and exported amounts to thousands of tons.

The main task of the Codex Alimentarius is to describe quality standards in the nutritional field to ensure the correct and healthy trade of food-type goods, as well as to define safety practices so that both consumers and producers can trust that they are relying on a system that guarantees the interests of both parties. The strength of the Codex is that the standards imposed are based on a sound scientific basis provided by bodies external to the organization or by consultants organized ad hoc by FAO/WHO. In fact, public health problems such as the use of pesticides, food additives and contaminants, are problems that the Codex has always put as main in their objectives.

[15] http://www.fao.org/fao-who-codexalimentarius/about-codex/en/

And it is precisely thanks to this scientific rigor, although the standards are recommendations made to the member states, in practice they are always taken as the basis for the laws issued in those countries.

The Codex Alimentarius is a collection of internationally adopted food standards and related texts presented in a uniform manner. These food standards and related texts aim at protecting consumers' health and ensuring fair practices in the food trade. The publication of the Codex Alimentarius is intended to guide and promote the elaboration and establishment of definitions and requirements for foods to assist in their harmonization and in doing so to facilitate international trade (World Health Organization, FAO 2019).

The main object of Codex standards is food in every form (intended for sale to the customer), whether processed, semi-processed or raw. And beyond that, the Codex Alimentarius considers provisions for food hygiene, additives, pesticides, contaminants, labelling and appearance, methods of analysis and selection, and import and export examination and guarantee.

Furthermore, a major challenge facing the Codex Commission is that with the exponential growth in trade over the past decades, they must take into account possible trends, take into account public health and implement practices that are fair for all parties and try to standardize policies as much as possible for all member countries. To succeed in this, the Codex Commission must take into account the FAO and WHO guidelines in its evaluations.

1.3.2 Last provisions

Now it is possible to get deeper in the open debate between countries, it is necessary to stress again why FOP labels, today, represent the best solution to malnutrition and for this reason they should be instituzionalized.

The WHO in their report begins by stating that : "Front-of-pack (FOP) nutrition labelling is a core component of the emerging "essential" package of policy recommendations to

address the growing global burden of diet-related noncommunicable diseases (NCDs)" (WHO 2016).

While many claim that, referring to the Back of Package (very detailed nutrient tables), it has been proved that this type of representation is not perceived by the vast majority of consumers because it is not very indicative and very complex and long. Since twenty years, more and more different types of Front of Pack labels (such as "traffic light" used mainly in the UK or the "warning labels" in Chile that were effective at the time of purchase for a healthier choice (Cecchini and Warin 2016)) are being developed and spread, whether or not coloured, which give the consumer a much clearer and quicker idea of the wholesomeness of the product he is buying.

The reason for the great success of FOPs lies in the great potential they have to combat malnutrition, as well as in their intrinsic benefits for both consumers and producers. In fact, on the consumer side, they will be more aware to follow a healthy diet and not run the risk of health problems. On the producer side, they will be able to obtain more information and data on how to produce new products based on consumer demands and trends through FOP. (E. Vyth, et al. 2010)

There is, however, a downside to FOP at the moment. It is the fact that until a few years ago they were neither regulated nor standardized. This is because regulation and standardization are problems not so easy to solve; in fact, especially in Europe, where states have very different culinary cultures and eating habits, it was not an easy task to find a solution that could be as general and applicable as possible. It was at this stage that the WHO asked the Codex to draw up guidelines that countries could follow for the diffusion of FOP labels.

The first problems were immediately highlighted, especially by the producers who claimed: "This lack of harmonization has resulted in the need for food industry actors to cater to different labelling requirements in different markets, even within the same trading region. Some mandatory FOP labelling initiatives have been subject to specific trade concerns, raised in the Technical Barriers to Trade Committee in the World Trade Organization" (A. Thow, et al. 2018).

It was precisely because of these kinds of problems, which represented high trade barriers for manufacturers, that Codex had to find appropriate standards to make the new labelling scheme work, be widespread and not disadvantage any market player.

So in 2016 the Codex Commission set up a working group called the eWG "electronic working group". The role of this group was to study the feasibility of this and make recommendations to the Codex Commission about food labelling. In addition, the eWG has submitted recommendations to the Codex directly from the International Association of Consumer Food Organization in 2016. After further studies and evaluation the first recommendation document was finally submitted to Codex in 2017, culminating with the approval of guidelines to standardize FOP labels by Codex in 2018 (A. Thow, et al. 2019).

The Codex leadership was accepted enthusiastically and positively by most with the belief that the adoption of FOPs would create a significant global impact. But there was no lack of criticism, in fact one of the most criticized aspects was "current institutional structures within the small and highly interconnected "regime complex" surrounding FOP nutrition labelling may result in a tempering of public health interests, in favor of industry interests" (A. Thow, et al. 2019, 12). But at the same time the counter argues that the path to the guidelines will involve not only the institutions but also the producers, and therefore from this dialogue there could be enormous benefits for public health, in fact in fact, they will be able to benefit from this, since, through strategic participation in meetings, they will increase their ability to tag, redesign their products and improve communication with their customers (WHO, NMH, NHD, FAO; 2018). In any case, in the next paragraph will be analyze how still today the dialogue on FOP is very open, between criticisms of member states and new proposals despite the fact that 9 years have passed since Article 35 1169/2011 legitimates them.

1.3.3 The open debate on FOPs, Italy vs France and UK

Although relevant scientific studies have now demonstrated the positive aspects of FOP labels and how they can fight malnutrition and consequently NCDs, it also important to take into account an aspect that has already been highlighted in the last paragraph: the difficulty of creating a scheme of FOP labels that can effectively communicate the true nutritional values that a food has, taking into account the context from which it comes. It

is therefore on this aspect that in Italy has recently been struggling against other countries such as France and the UK.

A few days before the conference on Food Labelling, held in Ottawa between May the 13th and 17th, 2019, the Italian government harshly criticized the draft of a WHO report called "WHO Guiding Principles and Framework Manual for Front-of-Pack Labelling for Promoting Healthy Diets". The report makes clear reference to guidelines for countries that are implementing a FOP labelling scheme. These FOP labels, that will be discussed in detail later on aim at promoting healthier diets and at achieving this by providing consumers with simpler and clearer patterns of understanding of the normal nutritional information found on the back of the product.

Currently about thirty WHO member countries are adopting and working on the development of FOP labels, including: the French Nutri-Score, Multiple-Traffic-Light in the UK, Health Star Rating in Australia, but also mandatory solutions such as "high in" used in Chile and Israel (Neal, et al. 2017).

Nowadays in Europe, the most widespread system are Nutri-score and MTL; these are based on a measurement algorithm that, based on 100 grams, classifies food from A to E in the case of Nutri-score, and by colours the nutrients in the MTL. And it is precisely on this factor that the Italian ambassador's criticism starts, in fact this method is in contrast to the principles of the Mediterranean diet[16] which is based on a balanced consumption of all foods.

The Ambassador refers above all to an Nomisma study which showed that one year after the adoption of the MTL in the UK, there has been a drastic decrease in sales of typical Italian products, classified as unhealthy by the English system which is based on the consumption of 100 g of the product. And this for the Italian government is mainly a political and economic move, rather than a real health concern[17].

The Italian ambassador's main criticism is that the WHO report with the guidelines on FOP labels is based on the concept of “nutrient profiles”, which, according to the Italian

[16] The Mediterranean Diet is considered one of the healthiest cuisines in the world. Although there is no real definition, it generally includes the consumption of a lot of fruit, vegetables and cereals. Moderate use of fish and red meat and healthy fat intake. It is a typical cuisine of the developed countries around the Mediterranean.

[17] https://www.repubblica.it/economia/rapporti/osserva italia/mercati/2018/11/23/news/nomisma_etichette_e_ricadute_economiche_ecco_lo_scenario_-212412634/

committee, is not based at all on scientific grounds, but rather on political motives. What is mainly discussed by the Italian committee is the sentence that appears at page 11 of that document: “Nutrient profiling is the science of classifying or ranking foods according to their nutritional composition”[18]. So the Italian ambassador Cornado, relying also on a statement made by EFSA, which is an external scientific body that states: "scientific limitations intrinsic in the use of nutrient profiles to classify foods”. And also EFSA underlined the “inherent difficulty in seeking to apply to individual food products nutrient intake recommendations that are established for the overall diet” (EFSA 2008). And also Cornado underline that none of the countries that introduced the Nutri-Score and MTL system recorded a remarkable enhancement on human health neither a decreasing in obesity rate.

Since the Mediterranean diet and the Italian model are based on the food pyramid[19], which does not exclude any food, but indicates the recommended amounts, so as to allow a varied and pleasant diet, but at the same time balanced from a nutritional point of view. The Mediterranean diet is based on education and awareness, not on prohibition. Nutrition in a balanced way does not mean giving up, but consuming all foods according to appropriate portions and frequencies.

This is why on January the 27th the European Commission was notified of the Italian proposal to bring into force the national labelling system named NutrInform Battery.

The Nutrinform Battery is in stark contrast to the Traffic Light system: it does not judge food by dividing it into "good" (green light) or "bad" (red light), but indicates to the consumer the nutritional intake of the food in relation to the daily requirement with specifications on the percentages of fat, sugar, salt and calories per portion of the food compared to the daily intake recommended by the EU.

The Italian proposal of the Nutrinform Battery adopts as a strategy to cope with the growth in the number of overweight people, that of clearly informing consumers about the presence of the macronutrients of interest indicated by the World Health Organization (WHO), i.e. calories, total fat, saturated fat, sugars and salt, so that they are aware of how much the intake of a portion of that product is able to "fill the battery" for each of the nutrients under examination. In this way It is evident the will to pursue, in an educational

[18] https://www.who.int/nutrition/topics/profiling/en/

[19] The food pyramid is based on the concept of making healthy eating easier for consumers. It is based on different levels of food priorities, at the base are fruit, vegetables and cereals, right up to the top where less basic food such as sweets are found.

and not coercive way, the objective of applying the dictates of the Mediterranean diet through the free choices of a conscious consumer without constraints or prohibitions.
For the realization of this project, led by four Ministries (Health, Economic Development, Agriculture and Foreign Affairs), nutrition experts from the *Istituto Superiore di Sanità* (ISS) and the *Consiglio per la Ricerca Economica e Alimentare* (CREA), as well as representatives of the trade associations of the agro-food chain and consumers, have taken the field.

The reference parameters on which the individual batteries are calibrated (one for each critical element, i.e. calories, total fat, saturated fat, sugars and salt) are the European ones set in Table XIII of EU Regulation no. 1169/2011 - art. 35, which are also in line with those of the LARNs (nutrient reference levels for the Italian population).

In the NutrInform Battery nutrition label, which is voluntary and not mandatory, each of the five batteries offers the consumer both a percentage and quantitative indication of the variable it represents (calories, sugars, etc.) for a portion of the product to be purchased. Therefore, simply by looking at each single battery, the consumer will immediately realize the exact percentage of the nutrient he is introducing with the portion of food consumed compared to the maximum recommended amount, and therefore how much of that nutrient remains to be taken during the rest of the day[20].

Obviously these criticisms from the Italian side have received a prompt response from the counterpart supporting the nutrient method. In fact, it is said that scientific studies have been working for many years to find out which method is best able to provide information to consumers and this is to use nutrients, criticizing the Italian counterpart, stating that taking into account the "quality" of food would be an unscientific term with too many meanings[21]. Moreover, they add, although not explicitly in the AJPC editorial: " used strategies that belong in the Big Tobacco playbook: shaping the evidence base, political and economic pressures, destabilizing scientific opponents, delaying the decision, and offering substitutions to the proposed policy" (Chantal 2018).

[20] https://www.nutrinformbattery.it
[21] https://www.thelocal.it/20190513/parmesan-and-prosciutto-wars-why-italy-doesnt-want-nutrition-labels-on-its-traditional-foods

1.3.4 Art. 35 D.lgs 2011 and the introduction of FOP Labels

Although, as will be seen in the next paragraphs, the first FOP Labels appeared in the early 1990s in the countries of Northern Europe, but as can be seen from the title of the paragraph it can be notice that in reality a real legislation that tried to regulate arrived only in 2011. In fact on 25 October 2011 the European Parliament and the European Council has legislated on new ways of presenting nutritional information on products, but it is important to focus especially on Article 35 of this decree, which states*: "To facilitate the comparison of products in different package sizes, it is appropriate to retain the requirement that the mandatory nutrition declaration should refer to 100 g or 100 ml amounts and, if appropriate, to allow additional portion-based declarations. Therefore, where food is prepacked and individual portions or consumption units are identified, a nutrition declaration per portion or per consumption unit, in addition to the expression per 100 g or per 100 ml, should be allowed. Furthermore, in order to provide comparable indications relating to portions or consumption units, the Commission should be empowered to adopt rules on the expression of the nutrition declaration per portion or per consumption unit for specific categories of food"*[22].

This article and the entire law has been legislated by the Commission in order to allow regulation of FOP Labels, also facilitating the control of FOP Labels for the Commission and facilitating the exchange of information between Member States, stakeholders on everything related to the extra declaration of information regarding the nutrient content of a product.

Precisely concerning the exchange of ideas and information, the Commission organizes meetings between EU and stakeholders at European level such as the Advisory Group on the Food Chain, Animal and Planet Health and organizations of EU Platform for Action on Diet, Physical Activity and Health.

To go more specifically into the regulation, from December 2016, Regulation (EU) 1169/2011 concerns the vast majority of FOP labels in circulation. The regulation standardizes what are the mandatory and fundamental elements that each FOP label must have in order to be used. "It must provide the energy value and the amounts of fat, saturates, carbohydrate, sugars, protein and salt of the food. The declaration must be

[22] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:304:0018:0063:en:PDF

presented in a legible tabular format on the packaging. Where space does not permit it, the information may be presented in linear format. This mandatory nutrition declaration is often provided on the back of food packaging". In addition to that "The content of the mandatory nutrition declaration may be supplemented voluntarily with the indication of the amounts of mono-unsaturates, polyunsaturates, polyols, starch, fibre, vitamins and minerals. This voluntary information must not be displayed to the detriment of space allocated to mandatory information".
And at the moment, to resume the debate held by the Italian Commission, all the information must be indicated in 100g or 100 ml, or at the most it can also be expressed in portions or per consumption unit of product[23].

However, it is interesting to note that it is precisely because of the need to have equal guidelines for all that has arisen the necessity to regulate everything several years after the appearance of the first FOP; but nine years after the regulation issued by the EU there is still more than open debate. In fact, it is not an easy issue to resolve, given that there are several important factors at stake, such as the health of citizens, but also the economic aspects of the export business which represent for many countries, as well as Italy, a really important source of income.

[23] https://ec.europa.eu/food/safety/labelling_nutrition/labelling_legislation/nutrition-labelling_en

Chapter II

2.1 Story of FOP labels

"*People's decisions are always influenced by the way their options are presented to them, and their behaviour is shaped by the design of the spaces in which it occurs*" (Scrinis and Parker 2016); this is what Richard Thaler and Cass Sunstein have written[24] in their opera "Nudge: Improving Decisions About Health, Wealth and Happiness". The concept of "*Nudge*" is very stressed by the authors, as it is considered as a fundamental tool to understand the cognitive path that leads to human decisions.

But, what is a Nudge? Thaler and Sunstein state that a nudge is: "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates" (Thaler e Sunstein 2008).

According to the Nobel prize-winner for Behavioural Economics, Thaler[25], human beings are actually irrational. However, irrational behaviour can be studied from a psychological point of view. Thaler's intervention was fundamental, because until that moment human beings had been considered as perfectly rational agents, instead, through the studies of the author it was understood that on the contrary agents were irrational and took "shortcuts" (heuristic decisions) that lead to biases[26]. And therefore, experts, taking into account consumer's biases can structure their interventions and actions to help consumers and guide them to the best choices for them.

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[24] Thaler, Richard, and Cass Sunstein. 2008. Nudge: Improving Decisions about Health, Wealth and Happiness. New York. Penguin Books.

[25] Thaler uses two terms to refer to the actors of his theories; Econi and Human. With the first, it refers to perfectly rational beings typical of mainstream economic theory and, with the second, to individuals operating in the real world, with their imperfections and elements of irrationality.

[26] A judgment (or prejudice), not necessarily corresponding to the evidence, developed on the basis of the interpretation of the information in possession, even if not logically or semantically connected, which therefore leads to an error of assessment or lack of objectivity of judgment

The two authors, in order to make this concept concrete, introduced the issue of nudging with a story: Carolyn is the director of the company that deals with providing food and snacks to schools. Carolyn, thanks to her vision and wit, notes how the arrangement of food and snacks at the school bar inevitably leads children to prefer certain products over others. She understands, therefore, that based on the position on the counter, "consumers" may be induced to prefer certain products rather than others. The authors continue the story, then go on to raise the notion that Carolyn should use her skills to design the counters in such a way as to lead the children towards what for them is the healthiest choice, but still leaving them a certain freedom of choice (Scrinis and Parker 2016).

So, what the authors wanted to express is the notion that any kind of information is provided, also based on how it is presented, has an effect on the consumer's choice behaviour, also called as “Framing Effect”. Any type of information presented to a person can therefore be considered a nudge, such as reporting the nutrients or calories of a food on its packaging (Scrinis and Parker 2016, 235). It is therefore of principal importance to better understand how this information works and presents itself, understanding the effects it can have on consumers.

For this reason the main objective of this second chapter is to introduce in more detail how FOP labels have developed and their main characteristics, to show in detail the most common ones and finally to introduce the new Italian answer to the other FOPs: the NutrInform Battery System.

Although FOPs have been introduced before, in order to understand their potential and the differences between the various types, it is necessary to go deeper, focusing on the fundamental elements that make them up, such as materials, methods. This will lay the foundation for greater awareness and understanding of the survey that will be presented in the next chapter.

2.1.1 Mission

In recent years, as it has been anticipated in the previous paragraphs, the focus on FOP labels has sparked great interest, whether in favor or not of them. FOP labels, which can be symbols, coloured, infographics etc., are used to summarize the nutritional information contained in the product and provide a degree of its healthiness. Although it may seem

natural or obvious to find information about the nutritional values of a product on a package, this has not always been the case. On the contrary, the evolution of this type of communication has been subject of laws regulating it and this has brought great interest from academic community, food producers and government (Feunekes, et al. 2008).

The main objective of FOP labels is, therefore, to facilitate understanding for consumers by directing them towards a healthier choice, also allowing an easier comparison between different products of the same category. "Hence, the provision of FOP nutrition information has the potential to increase consumer awareness, understanding, and usage of nutrition information, assisting consumers in making better food choices for themselves and their families"[27]. With better purchasing decisions made, according to the principles of libertarian paternalism[28] policy makers and producers have the opportunity to help consumers prevent NCDs and guide them towards healthier and more sustainable purchasing choices for their health (Pomeranz 2011).

Especially in Europe, the number of manufacturers using FOP labels on their products has been increasing for several decades, and at the same time the number of countries that have developed their own FOP labels is increasing (Hieke and Taylor 2012). In any case, because of a wide variety of FOPs, the debate and research on which is the best one, so able to better interpret and transmit the complicated nutritional information of the products to be used, is still ongoing. In fact, at international level there is no precise agreement on the main characteristics that a FOP should follow.

Although, as mentioned in the previous chapter, it should be remembered that the task of the Codex Alimentarius Commission, at present, is precisely to try to clarify guidelines that can lead to greater standardization of FOPs (Brownell and Koplan 2011).

The purpose of this chapter is to give a more in-depth overview of the fundamental characteristics of the different FOPs because, until now, most of the research carried out on them has been focused only on the effects of the consumers and their perception.

[27] Kees, J, Royne, M.B, Cho Y. 2014. Regulating Front-of-Package Nutrition Information Disclosures: A Test of Industry Self-Regulation vs. Other Popular Options. The Journal of Consumer Affairs.

[28] Thaler and Sunstein propose the concept of "libertarian paternalism" in their opera: "Behavioural Economics, Public Policy, and Paternalism" (2003). Libertarian paternalism claims the right to change the architecture of choice if it is shown to improve the quality of decisions. Leaving, however, the possibility of choice on the part of agents.

“Given the emergence of new FOP labels, in-depth insight into the different aspects that characterize existing FOP labelling systems is essential. These insights will create transparency and provide common knowledge on various aspects of different FOP labelling schemes” (Van der Bend and Lissner 2019).

In order to do this, the FOPs taken into consideration will be analyzed through the so-called "Funnel Model". Realized in 2014 by Van der Bend, this model allows to compare the different functionalities and characteristics of the considered FOPs (Van der Bend, et al. 2014).

So through the use of the "Funnel Model" in the next paragraphs, it will be possible to compare the functional and visual characteristics of the most popular FOPs. Also understanding the criteria and methodology with which they have been developed, leading to a deeper understanding of them and how they can influence the choices of key stakeholders such as scientists, producers and policy makers.

2.1.2 Introduction and Early Development

Although the use and diffusion of FOPs is mainly concerned in the last two decades, their history has, actually, a much older origin.
In fact, at the beginning of the 20th century nutritional labels began to spread on products, but their development was not very fast; this is probably because the adoption was done on a voluntary basis. Finally, at the end of the 20th century, governmental and non-governmental organizations began to implement the so-called “front-of-package” labels. Their main purpose was to summarize, in a simpler way, what was described in the nutrition labels, allowing, therefore, a greater effectiveness on consumers (Pomeranz 2011). But the main purpose of FOPs was not only designed for consumers, in fact, it can be said that the main objectives they wanted to achieve were two; first one was to, to guide consumers towards more informed and healthy choices. And second one was to, to encourage producers to rethink their products in a healthier way (Kasapila and Shaarani 2016).

The first country to develop a FOP label was Sweden, with its own Keyhole logo, in 1989. This was followed by Finland, in 1993, with a specific warnings label about unhealthy products. And then the first non-European country to develop its own FOP was

Singapore, called Healthier Choice logo in 1998. After these early years, in which a significant development had already taken place, in the early years of the 21st century, there was a sudden development of FOPs, caused mainly by the obesity emergency that was starting to spread alarmingly around the world (Schermel, et al. 2013).

Finally, in 2004, the WHO for the first time recommended FOPs as a method to fight malnutrition (World Health Organization 2004). "Thereafter, the WHO has repeatedly sought to promote FOP nutrition labelling as part of a comprehensive policy response to the global epidemic of obesity and diet-related non-communicable diseases, including through the Global Action Plan for the Prevention and Control of Non- communicable Diseases, the Commission on Ending Child-hood Obesity, and specific FOP nutrition labelling workshops" (World Health Organization 2013). In 2011, the European Commission officially legislated on FOPs with Article 35, which regulates them, of Law 1169/2011. In 2012, however, the Institute of Medicine has taken care to prepare a report that contains all the major recommendations to develop effective and really useful FOPs, giving precise indications on details to be provided, visual methods, etc (Institute of Medicine 2012). Currently, these standards are under analysis by the Codex Alimentarius Commission, which, as mentioned above, is working on guidelines that can be used by all countries wishing to develop their own FOP. The issue of proper regulation is at the centre of heated debates between countries (i.e. Italy versus France and the UK), but not only. In fact, according to the World Trade Organization, FOPs must be properly institutionalized because in some countries, such as Thailand, Peru and Chile, they represent a barrier to trade (A. Thow, et al. 2017).

In this sense the debate behind FOP is how much public health and the producers, hence commercial interests, can benefit. Interpretive schemes, such as the Multiple Traffic Light, which will, in fact, be the direct comparison in this thesis, are portrayed as promoting public health, while thumbnails and logos favor food industry interests (Grunert, Bolton and Raats 2012).

In conclusion, in order to overcome the uncertainties raised by the various agents of the discussion and to understand well how FOPs can be considered correct nudges, it is necessary to observe multiple aspects and to better understand their functioning and different characteristics. For this reason, in the following paragraphs The most

widespread FOPs will be introduced in detail, in order to provide as complete a picture as possible.

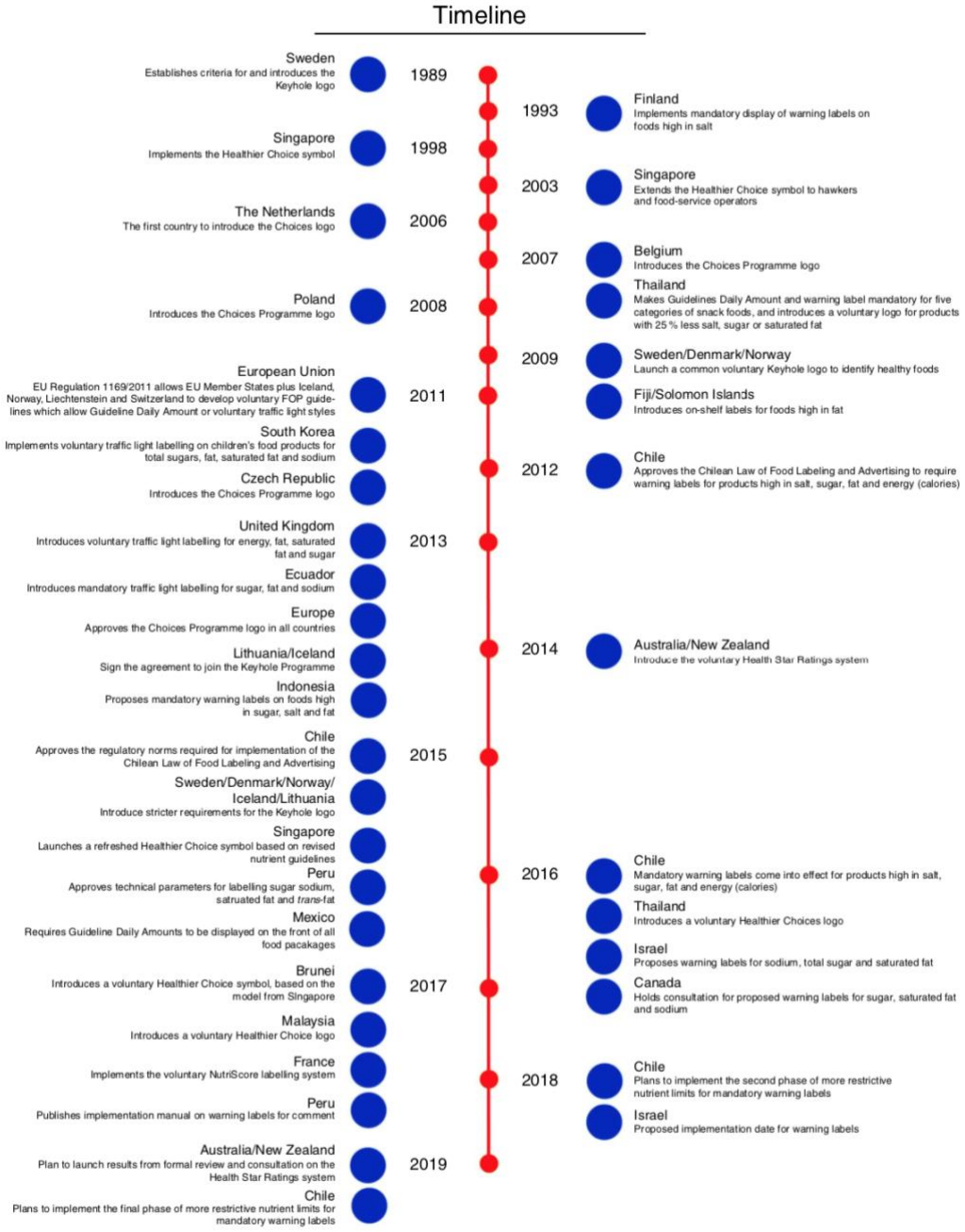


Figure 4: Timeline of FOPs. Source: R Kanter, 2018.

2.2 Main Characteristics of FOPs

2.2.1 Methods and Materials

As anticipated at the beginning of this chapter, to better understand how FOPs work, it is necessary to understand their structure and characteristics. It will be necessary to use in

this analysis the Funnel Model, developed in 2014. The Funnel Model categorizes European FOP labels according to their structural and visual functions, allowing for comparison. The only drawback of this model is that it only analyzes the FOPs that are implemented at national level, and not, instead, those implemented by specific retailers. The Model recognizes the validity of a FOP system only when there is a combination of different characterizing aspects within a FOP; these are: qualifying components, reference unit, measurement method, coverage, methodological approach, purpose, driver, directivity, tone of voice and utilization. In addition to this first distinction, the model places three other macro-categories that encompasses the aspects mentioned above; the three macro-groups are: "Component", "Methodology" and "Expression". According to experts the last two groups are crucial to study, because they refer to the methodology used for FOP and how the label is presented to the public.

In the next step, it will be analyzed in detail all the components mentioned above, in order to make clear the operation of the Funnel Model and the subsequent distinctions between FOPs.

Component:

- Can be distinguished between "qualifying" and "disqualifying", these terms serve to explain the constituent elements of the product, for example for the qualifying components; energy, protein, carbohydrates, etc. Instead for the disqualifying; sugars, additives, acid fat, etc.

Methodology:

- Reference Unit: in this case there is not much freedom on the part of the institutions, since producers have to comply with the EU Regulation 1169/2011; in fact, FOP can be expressed in 100 g/100 ml, in 100 kcal/KJ, or in % of Energy per day.
- Measurement method: on the basis of the FOP that is taken into consideration, in order to calculate the "result" of the product under consideration, it will be necessary to present the results either on the basis of a score or on the basis of a threshold.

- Coverage: FOP's coverage criteria can be extended to both individual products and entire product categories. With "entire product categories" it is meant all pre-packaged foods, although not including children's products, alcohol and energy products.
- Methodological approach: there is enough freedom for organizations on these aspects. In fact, if the specific FOP adopts an equal approach for the majority of products, it will be said that a "cross-sectional" approach has been used. On the contrary, if a specific-approach is used for that type of product then it will be said "food-category-specific" approach.

Expression

- Purpose: although the purpose of FOPs can be multiple, the first use is certainly to inform consumers, guiding them towards healthier food choices. In addition, it can be seen that FOPs can also contribute to a revolution in the preparation of products by producers.
- Driver: obviously the driver who is in charge of spreading the message is also crucial. In fact, is meant what support the FOPs, such as institutions, private organizations, etc.
- Directivity: this is a very important aspect, as it provides a fundamental distinction. In fact, FOPs can be further distinguished in three other categories; "directive" i.e. they do not show any kind of nutritional information but only provide the final response, "semi-directive" which together provide nutritional information, with simplified graphics. And finally, "non-directive" do not provide any kind of advice to the consumer, but only present nutrition data.
- Tone of Voice: such as for all types of messages, FOPs can present different ways of communicating your message. FOPs can, in fact, be found with a positive, neutral and negative message.
- Utilization: the use of FOPs is still quite arbitrary in the world. In many countries, in fact, they are still not very widespread because they are voluntary and therefore freely chosen by the manufacturer. In other countries, however, they have become mandatory, forcing producers to apply them on their products.

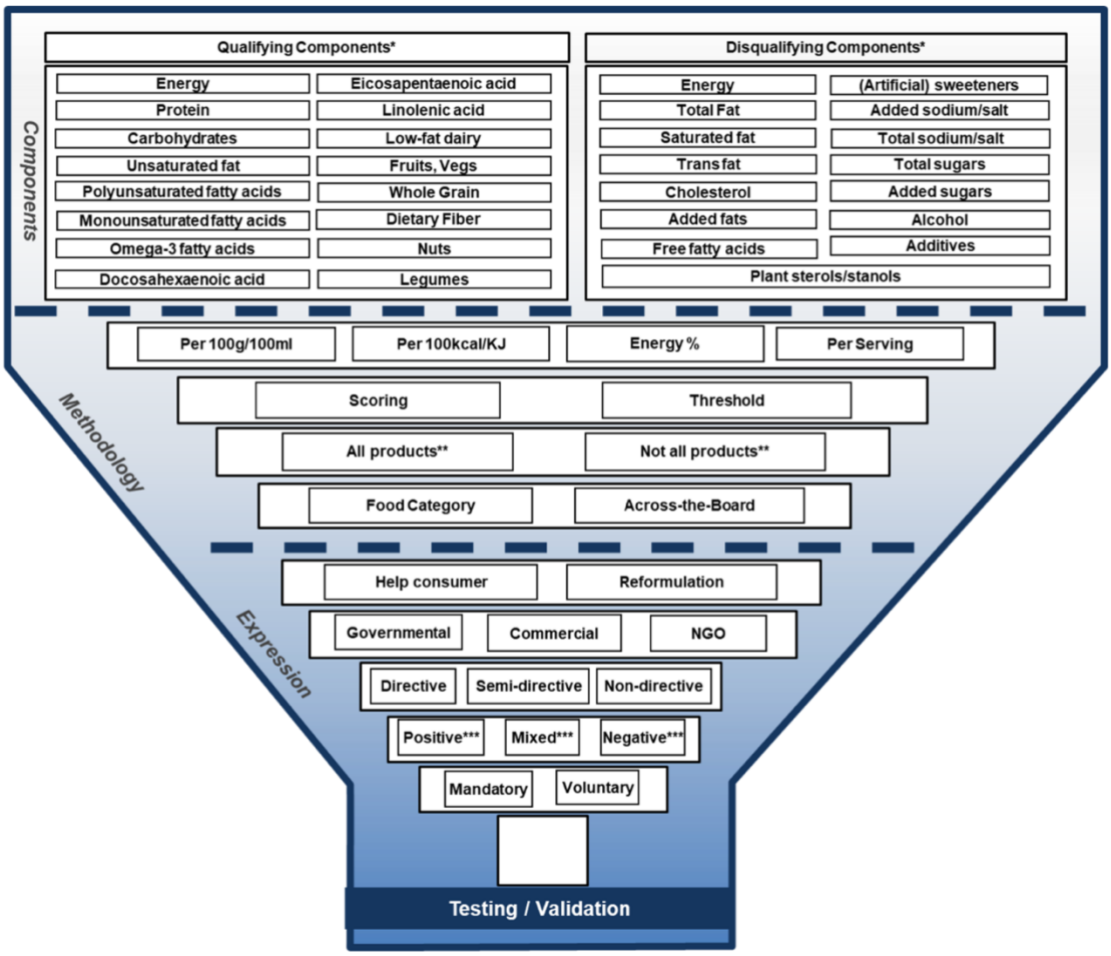


Figure 5: European Funnel Model. Source: Van der Bend and Lissner 2019.

2.2.2 Comparison between Positive, Mixed and Negative FOPs

Although a better understanding of the aspects that characterize FOP labels is important in order to understand the next comparisons, it is equally crucial to take the time to analyze a further distinction that can be made. In fact, between FOPs it can be possible to distinguish positive, mixed and negative. This distinction refers directly to one of the voices mentioned in the last paragraph, namely the “tone of voice".

This feature is influenced by the type of "Component" that the FOP contains, i.e.; positive FOPs will include more "disqualifying" components, but unlike the other two categories they also contain "qualifying" elements.

The components that are always used by FOPs positive are: dietary fiber, saturated fatty acid, total salt or sodium, and total sugar. Instead, the qualifying components that are

generally used by this category are: omega-3 fatty acids, wholegrain and dietary fiber. Finally, the disqualifying components that are most commonly used are: total fat, saturated fatty acid, trifluoroacetic acid, total sugar, added sugar, and total salt or sodium. In addition, the positive FOPs have the characteristic of having very similar distinctive features, they are, in fact, all directive, voluntary with the aim of encouraging on the one hand the information for the customers, but also to induce them to reformulate the product. Among the best known labels belonging to the positive FOPs, the Swedish Keyhole logo, Finnish Hearth Symbol and the Croatian label stand out (Van der Bend and Lissner 2019, 3).

As mentioned at the beginning of the paragraph, unlike the positive FOPs, the other two categories (mixed and negative) do not have any qualifying component, while in all the mixed and negative FOPs there are all the following disqualifying components: saturated fatty acid, total sugar and total sodium or salt. In addition, it is worth mentioning that while in the positives there is very often the presence of the "added sugar" component, this is completely absent in the other two categories of FOP. Generally, Nutriscore is catalogued as mixed, but it goes against the above-mentioned dictates of these categories, presenting exceptions in several aspects. In fact, even though a mixed has qualifying components, the criteria include proteins, which are not present in any of the criteria of any positive FOP. Another clear distinction between positive FOPs and others is the use by positives of the following criteria: "TFA, cholesterol, plant sterols/stanols, added fats, artificial sweeteners, added sodium, additives, alcohol and free fatty acids" (Van der Bend and Lissner 2019). Finally, one of the biggest and most important differences between the various categories is the method used. In fact, the positive labels all use a "category-specific" approach, which in practice applies as the use of different approaches for different types of product. On the contrary, mixed and negative labels use the same approach extending it to all product categories (except in the case of Nutriscore which differs).

	Positive FoP	Mixed FoP	Negative FoP
Components	Qualifying, Disqualifying	Disqualifying	Disqualifying
Reference Unit	100 g/100 mL, 100 kcal/KJ, per serving, energy %	100 g/100 mL, per serving	100 g/100 mL, per serving
Measurement Method	Threshold	Threshold	Threshold
Purpose	Help consumer, reformulation	Help consumer	Help consumer
Methodological Approach	Category specific	Across-the-board	Across-the-board
Coverage	Differs per label	All products	All products
Driver	Governmental, NGO's	Governmental	Governmental
Tone of Voice	Positive	Mixed	Negative

Table 1: summary table of Positive, Negative and Mixed FOPs

In conclusion of these introductory paragraphs, where the main structural characteristics of FOP labels have been discussed, in the next paragraph, the basis for understanding the facets of the labels will be introduced. In addition, the most popular FOPs at the moment will be analyzed to finally introduce the new Italian proposal; The NutrInform Battery.

2.3 Main FOP labels in circulation

2.3.1 Multiple Traffic Light

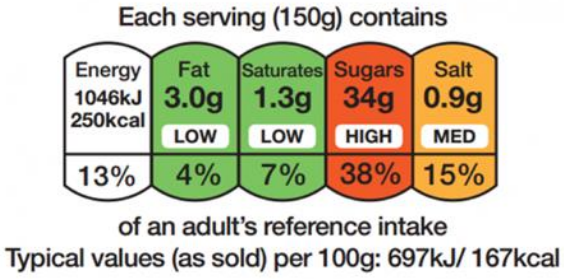


Figure 6: Multiple Traffic Light logo. Source: Van der Bend and Lissner 2019.

The first FOP that will be analyzed is the English label Multiple Traffic Light, one of the most widespread with Nutriscore; the label will also be the subject of a direct comparison with the Italian NutrInform Battery in the analysis that will follow in the next chapter. The MTL is a FOP of UK origin, developed by the Department of Health (DH) and adopted in 2013 (British Nutrition Foundation 2019).

One of the most striking features of this FOP is the use of colours, from green to red, that is a crucial aspect since: “Colour affects people psychologically, physically and economically” (Bosket, Harrington and Hirn 2012). In designing the label, the UK Department of Health felt it was of paramount importance to develop a FOP that visually impacted the consumer, also following the directives contained in the European Regulation 1169/2011 (Department of Health; Food Standards Agency; Welsh Government; Food Standards Scotland; 2016).

The MTL is a semi-directive FOP, as anticipated it uses a strong visual impact thanks to the colours and takes from the Reference Intakes the consumption percentages based on daily needs. “In line with the E.U. FIC, the MTL should be provided in either one of the following two formats: energy alone or energy plus total fat, saturates, total sugars and salt (‘energy + 4’). On-pack, reference bases are provided per 100 g/mL only, per 100 g/mL and per portion, or per portion only (applies only for ‘energy + 4’)” (Van der Bend and Lissner 2019). Beyond that the MTL is considered to be an across-the-board system and applies its own criteria to food and beverages without making distinctions on specific product categories.

MTL is also adopted in other countries outside Europe, such as Canada and Australia. As a highly valued label, several studies have demonstrated its ability to help consumers choose products containing less sodium or fat (Emrich, et al. 2017). Although the use of colours is criticized by some as being too "nudging" and too influential for the consumer[29].

[29] https://www.horecanews.it/nutrinform-battery-litalia-notifica-la-proposta-del-nuovo-sistema-di-etichettatura-allue/

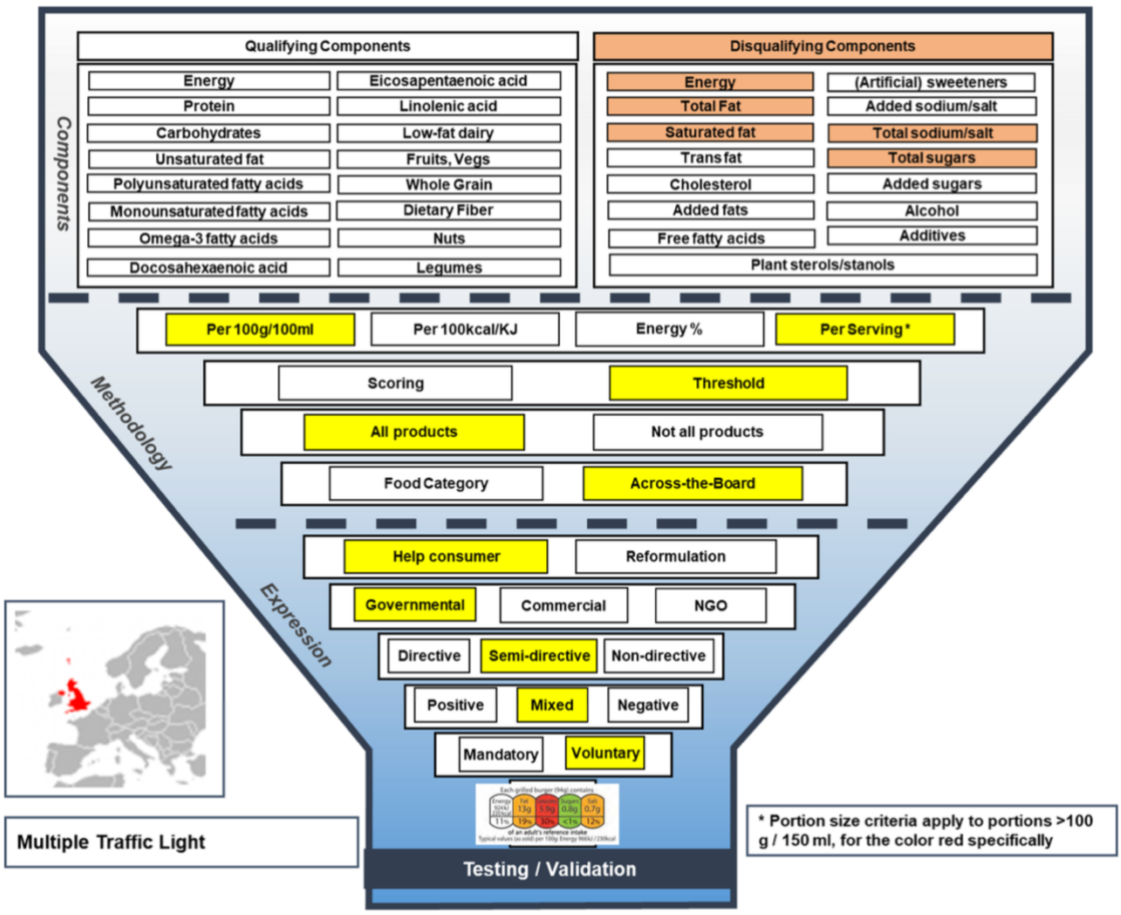


Figure 7: Funnel Model of the MTL. Source: Van der Bend and Lissner 2019.

2.3.2 Nutriscore

Figure 8: Nutriscore logo. Source: Van der Bend and Lissner 2019.

Nutriscore is the FOP label developed by the French government, now in use in several European countries, such as France, Germany, Belgium, Switzerland and it is under discussion in Spain, Netherlands and Luxemburg. It was officially adopted in France in 2017 and has been very successful among many EU members (Chauliac 2018).

In fact, this FOP has already been mentioned before, both because it is at the centre, together with the MTL, of the debate with Italy, and because it has anomalies for the FOP

category to which it belongs. As it can be seen from the figure above (figure tot), Nutriscore has five coloured boxes (from green for the most virtuous to red for the unhealthy), and each one is marked, moreover, by a letter; from A for the healthiest to E for the least healthy.

Nutriscore, since are used only colours and letters, without showing any additional information, such as nutrients content and daily quantities required, is classified as "directive", and because it presents a summary of its response is considered a Mixed FOP, and finally its use is on a voluntary basis (Askew 2018).

The Nutriscore criteria on which is based are both on a threshold basis and on an actual result. Beyond that, it contains both qualifying and disqualifying components, and finally, everything is calculated on the basis of 100g / 100 ml.
Here is the procedure for calculating the Nutriscore results: the total score is in a range between 0 and 40 points. This score is composed of several considerations, specifically positive points (0-10) are awarded for disqualifying components such as saturated fatty acid and sodium. Instead, points (0-5) are subtracted for qualifying components such as protein and fiber. The final nutrient classification (A-E), is defined by the upper and lower limits of the bounds for each of the classes considered.
“The Nutriscore is based on one set of criteria for all pre-packaged foods with a mandatory nutritional declaration in accordance with Regulation (E.U.) No. 1169/2011, although criteria modifications have been made specifically for cheeses, fats and non-alcoholic drinks, because of the score of these products would not be in line with dietary recommendations” (Chauliac 2018).

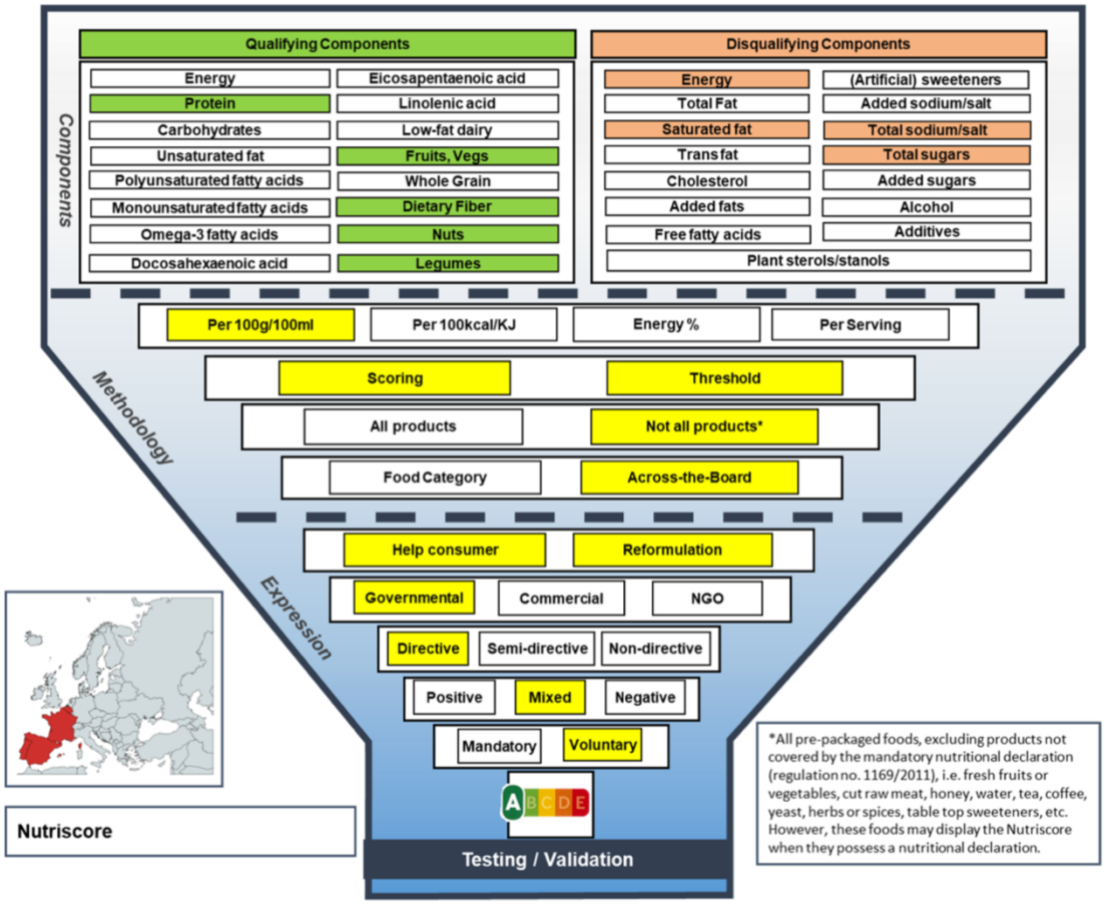


Figure 9: Funnel Model of the Nutriscore. Source: Van der Bend and Lissner 2019.

2.3.3 Keyhole logo

Figure 10: Keyhole logo. Source: Van der Bend and Lissner 2019.

The Keyhole logo, as mentioned earlier, is the longest lasting FOP. It was in fact established in 1989 in Sweden, developed by the manufacturer ICA Gruppen, but later taken over by the Swedish National Food Agency. Since its introduction, its use has also been extended to other northern countries (Denmark, Norway, Iceland). The Keyhole label is considered to be a positive and directive FOP and its main purpose is to guide the consumer towards healthy product choices. It uses the "food-category-specific"

methodology and beyond guiding the consumer, it stimulates product reformulation. In any case, this label is not applicable to all products, in fact it is not expected to be applied to hedonic products, such as cakes and snacks (Swedish National Food Agency 2018). The Keyhole is composed of both qualifying and disqualifying components, it is based on the threshold method and the results refer to a consumption of 100 g / 100 mL. (The National Food Agency 2015). Finally, nutrients such as added sugars are classified as disqualifying components.

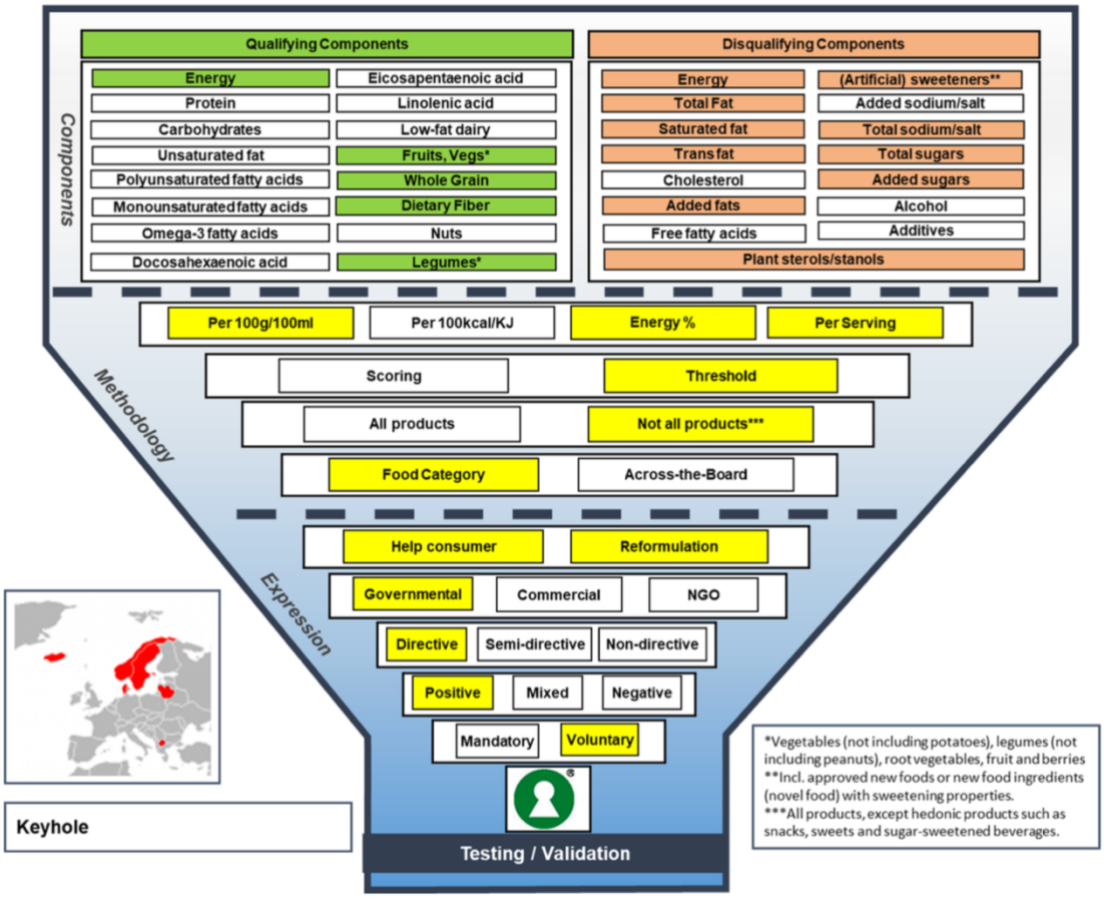


Figure 11: Funnel Model of the Keyhole. Source: Van der Bend and Lissner 2019.

2.3.4 Reference Intake

Figure 12: Reference Intakes logo. Source: Van der Bend and Lissner 2019.

The evolution of FOP Reference Intakes is perhaps the most peculiar. In fact, only since 2016 has it taken this name, being the evolution of the former "Guideline Daily Amount" adopted in 2005. Name changing was due to a willingness on the part of the EU, with the entry into force of Regulation 1169/2011, to harmonize the various FOPs circulating in Europe, so as not to create further confusion. This is also a FOP on a voluntary basis and a negative FOP. RI does not show any kind of positive component, but on the contrary only negative components, such as fat, sodium and sugar. It has a rather pronounced visual effect, presenting the negative components and showing in what percentage they are taken when consuming that product. The information provided refers to 100 g/ 100 mL per portion[30].

Although the GDA had a diffusion mainly in France and French-speaking countries, at present the RI is also very widespread in Denmark, Greece, Hungary, Holland, Norway, etc. RI aims to guide the consumer towards healthier food choices, and also encourages reformulation of the product by consumers and producers[31].

It is important to note that RI is not free from criticism. The most common is that the average, according to which the optimal intake of certain components is based on an adult's diet, thus making it of little use as an indication for children or the elderly (children). In addition to this, being a non-directive FOP, it is criticized for being unintuitive and very difficult for some consumers to understand, thus diminishing their ability to move towards healthier products.

[30] https://www.igd.com/articles/article-viewer/t/front-of-pack-labelling-around-the-world/i/23126
[31] https://referenceintakes.eu/index.html

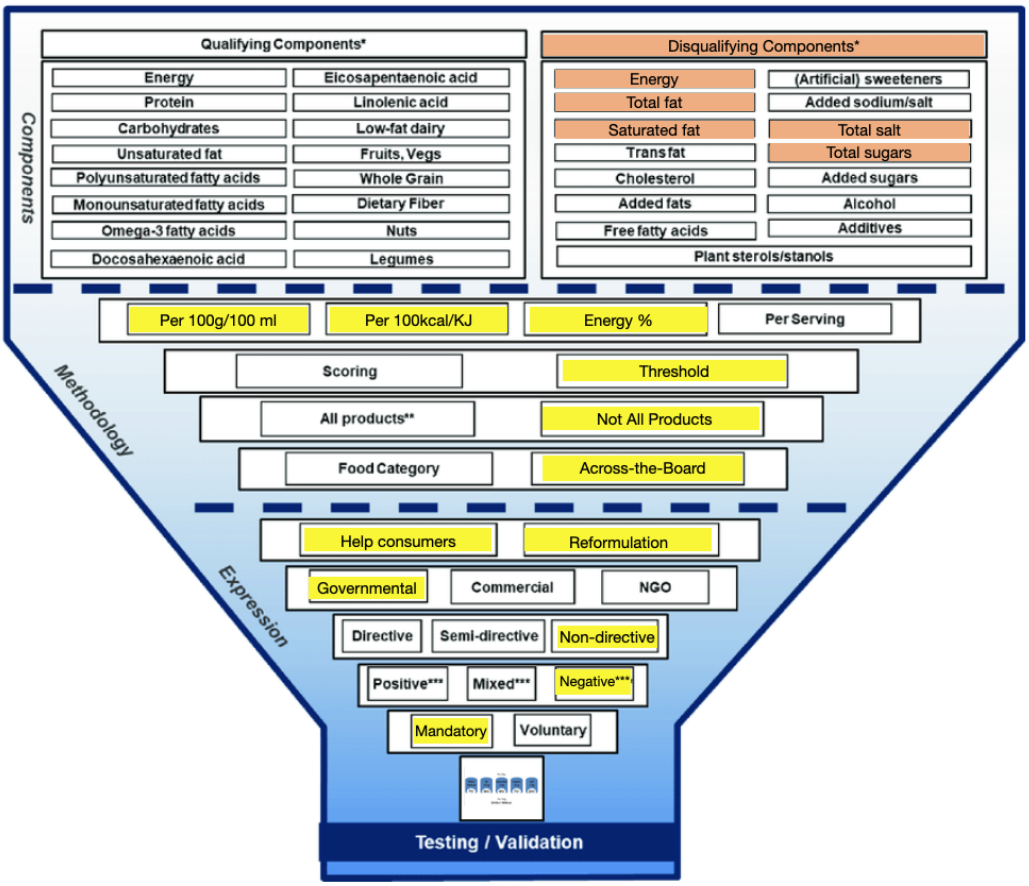


Figure 13: Funnel Model of the Reference Intakes. Source: Van der Bend and Lissner 2019.

2.3.5 Advantages and Limitations of FOPs

After analyzing some of the most popular FOPs in more detail, it is important to point out what benefits they can bring and what limitations they have. For policy makers this is a fundamental step, especially in the perspective in which the Codex Alimentarius is working on outlining guidelines that can objectively fit different players.

The goal of many scholars in recent years has been to understand whether FOP labels really help consumers, leading them towards healthier or less healthy choices.
In general, what can be said today is that FOP labels help consumers towards a healthier reformulation of products (Tarabella and Voinea 2013), but it must be kept in mind that there are several limitations that undermine this path for consumers.

In order to better understand the advantages and limitations of FOP to date, it is important to remember what the goals of a FOP label should be:

- First, to be able, through their visual qualities (such as colours, design etc.), to make themselves known to consumers and thus attract them to be consulted (Constantinescu 2011).
- As a second point, while attracting consumers is important, it must be done in accordance with the directives and guidelines drawn up by the institutional bodies. Their purpose is to reduce the intake of certain nutrients that are harmful to people's diet.
- In addition to guiding consumers on the choice of the individual product, the purpose of these labels is also to help consumers through product reformulation, understanding how best to integrate them into their diets. In this way they can acquire new eating habits that can contribute to the fight against NCDs.
- Inform consumers if a particular product contains very unhealthy nutrients, even beyond the normal standard. In fact, an American study shows that many consumers would like to be able to find a score scale from 0 to 3 on the packaging, indicating the degree of tolerance, in relation to a healthy diet, for these particularly harmful nutrients (Wartella, et al. 2011).

Having again clarified the objectives of FOPs, it will be easier to understand the advantages and limitations that have emerged in recent years. As introduced in this paragraph, in general it has been proven that FOPs help consumers to make healthier choices, in fact, a market study (European Food Information Council 2008) conducted in the UK has shown that UK consumers have a high degree of awareness and understanding of FOPs, as only one consumer in four researches further information displayed on the packaging (such as back-of-packages), and on average it takes about 25 seconds to make a decision, due to familiarity with FOPs such as MTL and RI (formerly GDA).

The great visual capacity of FOPs, especially MTL and Nutriscore, have a great impact on the ability of consumers to process information, it was found that about 89% understand the recommended guidelines for a healthy diet. While the use of colours is mostly misunderstood, in fact, about 73% of consumers tend to misunderstand the use of

the colour red in coloured FOPs, such as MTL and Nutriscore, giving the colour red a ban, rather than a simple "not to be consumed frequently". In addition, the use of the indicated portions per 100 g is not shared by most people (European Food Information Council 2008).

However, in Germany the studies focused more on which FOP was most effective among those in circulation. The study, carried out by Borgmeier and Westenhoefer, reveals that there is some certainty that FOP helps consumers compared to products without FOP, but their aim is to find out which one is the most effective. The problem they put at the heart of their study is that consumers may be confused, not comparing different FOPs in general, but gaining concrete benefits when comparing different products of the same category. However, unlike in the UK, coloured and therefore visually striking FOP labels such as MTL and Nutriscore are preferred in Germany as consumers feel more driven (Borgmeier and Westenhoefer 2009).

Although, on the one hand, there is a strong criticism of the use of colours, which would be all too strong advice, which then unconsciously affects consumers in the wrong way. On the other hand, FOPs like RI, which do not use any kind of colour, but only numbers and percentages, so they are not very graphic, require a certain degree of consumer education, which is not always taken for granted. In addition, having only numbers prolongs information processing time, making it more time-consuming (Tarabella and Voinea 2013).

One of the biggest limitations identified by the experts, however, which affect all FOPs, is that consumers are confronted with many different FOPs in the same marketplace (Schor, et al. 2010). Scholars Grunenter and Wills, in one of their work, point out how having so many schemes, so different from each other, leads to much confusion in the minds of consumers. This is fuelled by the fact that many FOPs, reporting visual schemes and information in different ways, make it difficult to compare products even of the same categories (Grunert, Wills and Fernandez-Celemín, Nutrition Knowledge, and Use and Understanding of Nutrition Information on Food Labels Among Consumers in the UK 2010) . This thesis is also supported by the scholar Draper, who shows in his research how the absence of guidelines that standardize the use of FOPs, inevitably leads to much

confusion and in some cases to wrong conclusions about the message that labels want to convey instead (Draper, et al. 2011).

What can be deduced from these studies is the fact that there is a need for the market to find a standard way to implement these FOPs. The advantages are now universally clear, but guidelines are still missing and this is a problem that the Codex has been charged with.

Current patterns are sometimes confusing or unclear to some, while others tend to give too strong nudging in consumers' minds (i.e. use of colours). For this reason, the Italian government, together with other authoritative bodies, has decided to develop its own FOP, which incorporates the advantages of the various categories (use of a graphic impact, but not too graphic and use of precise numbers and data on nutrients). And this is exactly what will be analyzed in the next paragraphs, the new Italian proposal: the FOP NutrInform Battery, which could represent a turning point in this field.

2.4 The New Italian Answer: NutrInform Battery

There has been a lot of talk so far about how heated the debate between FOPs is. Criticism of the other systems currently in place has been analyzed, and there has been mention of Italy's intention to present its own FOP. In fact, in January 2020 the proposal was officially presented to the EU Commission and is now approved[32].
Although the background and past history has been widely debated, in order to better understand the characteristics of this new FOP. it is necessary to explain first of all the basis on which it starts and is developed and secondly what are its main features and what, therefore, makes it the best FOP on the market.

2.4.1 General Setting

The Italian experimentation started in 2018 by carrying out a survey on a sample of 1,500 consumers interviewed online. In 2019 a further survey realized by Mazzù, Romani and Gambicorti (2020) was launched to test the subjective understanding and liking of NutrInform and comparing it with the Nutriscore. The test has been realized in field,

[32] https://www.eunews.it/2020/07/29/commissione-ue-approva-etichetta-italiana-batteria-la-soddisfazione-del-settore/133084

reaching 200 Italian respondents divided in two homogenous groups, representative of the Italian population. Therefore, each responsible for food purchases, representative of each family, had to rate understanding and liking of the FOP label he/she saw (NutrInform Battery or Nutriscore), which was associated to 10 different products, two for each of the following categories: sauces (tomato and ricotta and tomato and basil), yogurt (fruit yogurt and zero fat fruit yogurt), crackers (classic and corn), biscuits (classic and without sugar) and processed meat (salami and cooked ham). (Mazzù, Romani and Gambicorti 2020).

Although the study just mentioned refers to a direct comparison between Nutriscore and NutrInform, there are still some very interesting insights into NutrInform. From the analysis of the results, in fact, it emerges that NutrInform is perceived by consumers as a very understandable and helpful FOP to guide consumers towards healthier choices. To be clear, it is useful to report some data recorded in direct comparison with Nutriscore. These considerations are confirmed by the tests carried out through the data collection of the survey, in fact, it can be noted that, precisely in reference to the perception of the Italian FOP and its comprehensibility, the NutrInform outdone the Nutriscore with a mean of 5.4 vs. 4.5 ($t(198)1⁄43.91$; $p<.01$). Again, it is relevant to note that the same trend in results has been confirmed in another aspect such as FOP's ability to guide consumers in their purchasing decisions. In fact, it was found that NutrInform was more effective than Nutriscore in guiding consumers in more informed purchasing choices, scoring as follows NutrInform Battery: 5.3 vs. Nutri-Score: 4.2, $t(198)1⁄44.55$, $p<.01$). (Mazzù, Romani and Gambicorti 2020).

Therefore, the results of the experimentation lead to the conclusion that an "information" label is more accepted by the consumer who will then make choices that take into account the real physical characteristics of each consumer by adapting the consumption of the food in each different basket to his or her diet[33].

The voluntary system is not expected to be adopted by PDO, PGI and TSG products as these quality schemes, promoted by the European Union with the Reg. (EU) n. 1151/2012, are recognized by the consumer thanks to the quality label affixed there. The affixing of a logo of nutritional nature, although optional, next to the quality label of PDO,

[33] https://www.ruminantia.it/nutrinform-battery-lo-schema-di-decreto-notificato-alla-commissione-ecco-i-dettagli/

PGI and TSG products would make them lose their distinctiveness in the eyes of consumers.

Taking into account the above considerations, it was considered appropriate, proportionate and convenient to recommend the logo to the whole agri-food chain, confident that the system thus identified would not create obstacles to the free movement of goods, nor prejudice competition between operators, as it is objective and non-discriminatory as expressly required in Article 35.

2.4.2 Main Characteristics

Figure 14: NutrInform Battery logo. Source: NutrInformBattery.it.

"*The Italian proposal for a Europe-wide harmonized package face nutrition labelling system. For a conscious choice"*[34].
As mentioned in the last paragraph, the development of the NutrInform Battery has a recent origin. Studies began in 2018, debates continued in 2019, and then arrive in January 2020 with the official proposal to the EU Commission and recent approval.

This FOP is clearly inspired by the already analyzed Reference Intakes. This is particularly noticeable by the fact that nutrients are exposed with numbers and percentages based on ideal consumption. The most noticeable difference is certainly the presence of stylized batteries. In fact, the development bodies of NutrInform wanted to overcome the criticism against RI, according to which it would be particularly complex to understand the information for some consumers, and to include a graphic element. In fact, the battery visually represents the recommended percentage intake of specific nutrients. The use of a colour, strongly criticized in other FOPs such as MTL and Nutriscore, has been excluded.

[34] https://www.nutrinformbattery.it

To be more specific, the NutrInform Battery is a FOP, just like the RI, non-directive, nutrient-specific (Savoie, et al. 2013) and reductive (not interpretable) (Newman, Howlett and Burton 2014).

This makes it a rather technical FOP, with the precise aim of helping consumers by directing them towards healthier diets and supporting product reformulation. In any case, the addition of the more graphic component, such as stylized batteries, serves to overcome the criticism levelled at RI, with regard to the difficulty for consumers to understand it.

Below is a detailed analysis of the components that make up the NutrInform Battery:

Figure 15: NutrInform Battery elements section. Source: NutrInformBattery.it.

1. This first writing indicates that all the values expressed by FOP refer to the single portion consumed, expressed in 50 g.
2. Each box contains a quantitative indication of the energy, fat, saturated fat, sugar and salt content of the individual portion. The energy content is expressed both in Joules and Calories. The contents of fat, saturated fat, sugars and salt are expressed in grams.
3. The "battery" symbol indicates the percentage of energy, fat, saturated fat, sugars and salt provided by the individual portion of the product in relation to the recommended daily intake. The recommended daily intake amounts in EU are:

    Energy: 8400 kj / 2000 kcal

    Fats: 70 g

    Saturated fats: 20 g

    Sugars: 90 g

    Salt: 6 g

4. The charged part of the battery graphically represents the percentage of energy or nutrients contained in the single portion, allowing to quantify it also visually.

Now, once NutrInform it is been listed all the components that make up this new FOP, before presenting the criticisms made to NutrInform, it is useful to summarize the main differences of presented FOPs in a table below.

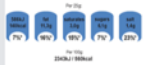
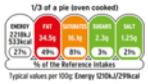
Feunekes et al. (2008)	Hodgkins et al. (2012)	Newman *et al.* (2014)	Savoie *et al.* (2013)	Julia & Hercberg (2017)	Examples	
More complex schemes	Non directive	Reductive (non-interpretable)	Nutrient Specif labels	Numerical	NutrInform Battery	
More complex schemes	Non directive	Reductive (non-interpretable)	Nutrient Specif labels	Numerical	Reference Intakes	
More complex schemes	Semi-directive	Evaluative	Nutrient Specif labels	Colour-coded	Multiple Traffic Light	
Simple schemes	Directive	Evaluative	Summary indicator labels	Endorsement logos	Keyhole	
Simple schemes	Directive	Evaluative	Summary indicator labels	Graded indicators	Nutriscore	

Table 2: summary table of the analyzed FOPs.

Although the surveys that have been developed have shown that there is a general appreciation by consumers for this new label, there has been no lack of criticism of this new system, which has been described as misleading and clumsy[35].

2.4.3 Critics to the NutrInform Battery

As mentioned earlier, there has also been no lack of criticism of NutrInform. The main ones come directly from the Italian editorial "Altroconsumo". The article criticizes the Italian decision for having chosen NutrInform. In the editorial's opinion, NutrInform would actually be a wrong choice, as it is a FOP that tends to confuse rather than help consumers. They are criticized for not opting for colours, which is very much appreciated in MTL and Nutriscore, and the choice to add batteries would, according to them, lead to

[35] https://www.altroconsumo.it/alimentazione/fare-la-spesa/news/nutriscore

an additional effort on the part of the consumer. When the infographic that would represent a daily percentage of the consumption of some nutrients would be misleading, because in the common mentality the more batteries are full the better is. Another very underappreciated feature would be to choose to express the values in relation to 50g portions instead of 100g like all other competitors, posing additional difficulties if the consumer wants to make a comparison between products and there are more FOPs used[36].

The absence of colours is particularly highlighted by publishing, saying that colours would help the consumer, as they would put a sense of alert, which NutrInform cannot do. They conclude by saying that on the contrary, the colours of directive labels work as activators of the sense of alert and self-control, so much so that the first available studies show that in particular the colour red on food encourages consumers to choose smaller portions.

It is relevant to report that one of the major critical issues stated, namely the use of the battery symbol that would lead consumers to a misreading, has been refuted by the study made by Professor Mazzù et al. previously mentioned, which would show how the use of the battery would not be perceived as an impediment in the understanding of FOP. In fact, mentioning the 1997 study by Gregan-Paxton and John, in which the steps leading to the learning of individuals are analyzed, one can see how human beings tend not to learn always and anyway by analogy, but it all depends on the context. Therefore, the criticism of the use of the logo of the charged battery would not result in a misreading of the FOP warning message against a product that is too loaded with certain nutrients (Gregan-Paxton and John 1997). This is amply demonstrated through the data collected during the survey administered, in a specific section of it where the degree of consumer understanding of the battery was tested. This has been done asking people their thoughts and their emotions in front of a mobile battery and the NutrInform battery in order to analyze if the different contexts influence the correct understanding of the battery symbol. The test proved that there is a broad public understanding of how FOP works and in particular of the visual use of the logo of the charged or discharged battery depending on the situation and its meaning (Mazzù, Romani and Gambicorti 2020).

[36] https://www.altroconsumo.it/alimentazione/fare-la-spesa/news/nutriscore

Once the most critical issues against the NutrInform Battery have been analyzed, all that remains is to perform a quantitative analysis on a sample of the population. By directly comparing NutrInform with MTL, it is possible to demonstrate whether or not this new proposal will affect consumers' purchasing intentions and whether or not it will help them choose healthier products. It also analyzes the level of consumer understanding of the NutrInform Battery.

Chapter III

3.1 Marketing Analysis

At this point the global situation of clinical cases concerning NCDs, trends related to nutrition, the economic and political commitment made by the institutions have been explained, and the history and characteristics of the major FOPs in circulation has been specified in details. The time has come, for this chapter, to report the results of the marketing analysis conducted online in the last quarter of 2020, concerning the comparison between the newly born NutrInform Battery and the English Multiple Traffic Light.

The use of FOP labels, as already mentioned, is currently one of the best tools in guiding consumers towards more informed and healthy purchasing choices. As seen in the last chapter, many different FOPs have been developed over the years. One of the fundamental aspects of FOPs is their ability to be understood, as the use of some visual or non-visual tools can change consumers' choices in one way or another. In recent years, to ensure greater transparency for consumers, it has been decided to develop a new FOP, the NutrInform Battery. As this has only recently been approved, there are not yet many studies that measure consumer understanding of other existing FOPs. For this reason, the objective of this study is to check the degree of understanding and liking, which are two dimensions that will be better defined later, by consumers towards NutrInform Battery and Multiple Traffic Light (MTL) FOP.

The study that was carried out was administered to an Italian audience of users, who were asked for their opinion on their perception of the two FOP labels cited above. More specifically, were surveyed the users' perceptions in terms of subjective understanding and liking of the Italian FOP and the MTL. It is correct to specify above all the concept of subjective understanding and the reason why the research is focused on it. In fact, understanding can be of two types: subjective and objective. The first refers to the degree of understanding that consumers believe they have learned from FOP communication (in this study). On the other hand, objective understanding is aimed at verifying whether the

consumer actually understood what the sender of the FOP wanted to communicate (Grunert and Wills 2007) .

The reason why the analysis focuses on subjective understanding lies on the fact that both MTL and NutrInform presents its information in a factual way, and it would therefore be superfluous to go to verify the objective understanding, since no interpretation is required.

The second response, as said before, concerns liking. This variable is equally important, because it allows to analyze how the consumer reacts to aspects such as: colours, appearance, symbols, etc. It allows to understand if consumers consider it easy and useful. "Liking is an important aspect for acceptability and elaboration" (2015).

Moreover, according to Mazzù et al. the responses "understanding" and "liking" do not necessarily have to be connected to each other, but are used mostly because together they can more easily detect the degree of storage and understanding of the FOP, allowing its implementation and future development on products (Mazzù, Romani and Gambicorti 2020).

For this study it was decided to consider, on the one hand, the NutrInform Battery, as it is the last approved FOP and on the other hand, the Multiple Traffic Light, a FOP that is semi-directive, with a strong usage of a visual impact thanks to the use of colours, and particularly used in Anglo-Saxon's countries.

The experiment was developed in the form of a questionnaire, in which respondents were offered four different categories of products: crackers, yogurt, cookies and sauce. Two different conditions were created, the first with NutrInform and the second with Multiple Traffic Light. As a result, respondents were randomly assigned to one of the two conditions and were offered products of the above categories with either NutrInform Battery or Multiple Traffic Light.

The experiment aims at answering the following research questions:

RQ1: What impact have MTL and NutrInform FOP labels on the consumers' subjective understanding of nutritional information?

RQ2:What impact have MTL and NutrInform FOP labels on the consumers' liking?

Finally, we expect to verify that NutrInform Battery will be more efficient than Multiple Traffic Light in terms of clarity and usefulness in guiding consumers in their purchasing processes. With a higher quality of providing clear and concise information about the degree of healthiness of a product. In accordance to the above, the hypotheses are:

H1: NutrInform Battery performs better than Multiple Traffic Light in terms of subjective understanding.

H2: NutrInform Battery performs better than Multiple Traffic Light in terms of liking.

3.1.1 Stimuli

The analysis was developed in the form of a questionnaire, which was disseminated online on the Prolific platform during September 2020.

In this quantitative analysis two types of stimuli were used: the first was the graphical use of the NutrInform Battery, and for the second stimulus the Multiple Traffic Light was used. Precisely because visual stimuli were used in the analysis it was necessary to report the results obtained in a previous pilot study conducted by Professor Mazzù, Professor Romani and the researcher Gambicorti in which the correct understanding of the symbols used in stimuli in the food sector was tested (specifically the use of the battery in the NutrInform Battery, which as reported has been harshly criticized).
They randomly selected respondents were assigned to one of four conditions: a 15% charged battery of a phone, a 75% charged battery of a phone, a 15% charged battery of NutrInform and a 75% charged battery of NutrInform. The result that was highlighted is that the respondents had no problems in understanding the meaning of the battery in different contexts, thus going to refute the criticism made against the use of the battery that would have been misleading (Mazzù, Romani and Gambicorti 2020).

3.1.2 Research Design

As for the design and the study population of the analysis, it was decided to structure the questionnaire with a between-subject design and beyond two conditions were set, and they are: condition 1 NutrInform Battery, while condition 2 was formulated with the

Multiple Traffic Light. Specifically, for each condition has been assigned the same product category: yogurt, cookies, sauces and crackers.

The questionnaire was structured according to the following pattern:

- Introduction, prolific ID, sociodemographic information and product randomization with the corresponding FOP
- Subjective understanding and liking of one of the randomically assigned product categories

In the first section of the survey there are questions about the segmentation of the respondents where they are asked about their demographics including age, level of education, employment, and whether or not they are in charge of food shopping. At the end of this part, the respondents are exposed to one of the conditions and so it is shown the packaging of one of the four product categories available in the test, with either the NutrInform or the Multiple Traffic Light on it. The proposed image shows the front packaging of the available products, with the randomly assigned FOP label clearly visible on top of it. It was decided to present only products without brand so as not to affect the respondent in any way. So, to clarify, the respondent may find the result of 2 stimuli (NutrInform or Multiple Traffic Light) x 4 product categories (yogurt, crackers, sauce and cookies), for a total of 8 possible images.

The second section, however, aims at measuring the degree of understanding of the FOP label submitted, focusing primarily on FOP's ability to inform with concise and clear information. Also the liking was tested. This measure was assessed through the following scales "How do you evaluate this label?", answers are based on: “good/bad” and “Negative/positive” ” (Allen and Janiszewski 1989).

Figure 16: (left) Crackers with Multiple Traffic Light label and (right) NutrInform Battery

Figure 17: (left) Cookies with Mutiple Traffic Light and (right) cookies with NutrInform Battery

Figure 18: (left) Sauce with Mutiple Traffic Light and (right) sauce with NutrInform Battery

Figure 19: (left) Yogurt with Mutiple Traffic Light and (right) yogurt with NutrInform Battery

3.1.3 Data collection

The main objective of this study is to examine the degree of subjective understanding and liking that consumers have of two specific FOP labels: NutrInform Battery and Multiple Traffic Light. In order to better define the subjective understanding of the FOP other sub-

dimensions have been used, such as: comprehensibility, design, help to shop and complexity. All these sub-dimensions are taken from a previous study (Moser, et al. 2010).

From the study conducted, the following measures can be inferred:

1) Subjective understanding: as it has been already said, it measures the degree of understanding that consumers have of the FOP in question, but in order to measure it, the following sub-dimensions are needed.

a) Comprehensibility: measured through the item identified by Moser (Moser, et al. 2010): " I fell well informed by the food label", "This label is believable and trustworthy" and "This label is easy to interpret".
b) Help in the shop: measured according to the items studied by Moser (Moser, et al. 2010): "This label helps me to understand the product composition", "This label helps me to understand different nutritional values" and " This label makes it easier to choose food".
c) Complexity: measured thanks to the following items tested by Moser (Moser, et al. 2010): "The food label is rather extensive" and "Using this food label to choose food is better than just relying on my own knowledge about what is in them".

2) Liking: this dimension evaluates the FOP presented according to the vision of the consumer and his/her liking and the question that allows to measure this dimension is: "How do you evaluate this label?", answers are based on: "good/bad" and "Negative/positive" (Allen and Janiszewski 1989).

3.2 Results

The questionnaire, structured online on the Qualtrics XM platform, was published on the Prolific portal on Septmeber the 14th, 2020 and received a total of 401 responses. However, it was decided, for a better statistical accuracy, not to consider all respondents who had completed the survey in less than 2:30 minutes (150 seconds), since the average response time to the questionnaire was 6 minutes (360 seconds); given the too fast compilation time, it is assumed that respondents did not pay the right attention to the

questions. Thus, receiving a total of 395 valid answers. The questionnaire was structured in Italian language for an Italian audience. It was decided to structure the questionnaire with a in between-subject design, presenting to the respondents 4 possible different product categories (yogurt, cookies, crackers and tomato sauce), randomly assigned, with two of the possible conditions set: 1) NutrInform Battery 2) Multiple Traffic Light.
Different stimuli were used in the analysis, namely respondents could be assigned 4 product categories X 2 possible FOPs, NutrInform Battery or MTL, for a total of 8 possibilities. For this study it was decided to use unbranded products, so that respondents would not be conditioned in any way as brands potentially familiar to them, allowing them to focus more on the visual effect of the FOP placed on the packaging and clearly visible.

The dimensions, instead, the study aimed at studying are: subjective understanding and liking.
Finally, the collected data were downloaded in Excel format directly from the Qualtrics XM platform and all subsequent statistical analyses were carried out on the SPSS software.

3.2.1 Frequency analysis

In this first section of the analysis the data related to the socio-demographic information, which the respondents found at the beginning of the questionnaire, are presented. The frequency tables, used to measure this data, are a type of descriptive statistics, mainly used to categorize the data. In this study, frequency measurement was used to collect the following information: gender, age, educational attainment, employment, income, responsibility for spending, and whether one was suffering from some of the diseases described.

Sociodemo gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Man	202	51.1	51.1	51.1
	Woman	190	48.1	48.1	99.2
	Other	3	.8	.8	100.0
	Total	395	100.0	100.0	

Table 3: Sociodemo gender table. Source: SPSS output.

Sociodemo age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	181	45.8	45.8	45.8
	25-34	139	35.2	35.2	81.0
	35-49	59	14.9	14.9	95.9
	50-64	16	4.1	4.1	100.0
	Total	395	100.0	100.0	

Table 4: Sociodemo age table. Source: SPSS output.

As can be seen from the sociodemo gender table above, of the 395 respondents, a frequency of 202 respondents was recorded for men (51.1%), 190 for women (48.1%) and finally 3 respondents under the voice other (0.8%). Among all respondents, the majority with 45.8%, was aged between 18 and 24 years, followed by the 25-34 year old group (35.2%), and finally the 35-49 and 50-64 year old group with 14.9% and 4.1% respectively.

Sociodemo education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No degree	6	1.5	1.5	1.5
	High school diploma	185	46.8	46.8	48.4
	Bachelor degree	103	26.1	26.1	74.4
	Master degree	81	20.5	20.5	94.9
	Phd	20	5.1	5.1	100.0
	Total	395	100.0	100.0	

Table 5: Sociodemo education table. Source: SPSS output.

Sociodemo occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Full-time worker	92	23.3	23.3	23.3
	Part-time worker	32	8.1	8.1	31.4
	Unemployed	48	12.2	12.2	43.5
	Student	186	47.1	47.1	90.6
	Retired	1	.3	.3	90.9
	Household	4	1.0	1.0	91.9
	Self-employed	32	8.1	8.1	100.0
	Total	395	100.0	100.0	

Table 6: Sociodemo occupation table. Source: SPSS output.

Sociodemo income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 20.000 euro	180	45.6	45.6	45.6
	20.000-40.000 euro	148	37.5	37.5	83.0
	41.000-60.000 euro	48	12.2	12.2	95.2
	61.000-80.000 euro	14	3.5	3.5	98.7
	81.000-100.000 euro	2	.5	.5	99.2
	Above 100.000 euro	3	.8	.8	100.0
	Total	395	100.0	100.0	

Table 7: Sociodemo income table. Source: SPSS output.

Of the 395 respondents, 46.8% have a high school diploma, 26.1% a Bachelor's degree, 20.5% a Master's degree, 5.1% a Phd and finally only 1.5% do not have a degree.

With reference to the table on employment it is possible to see that 47.1% of the respondents are students, followed with 23.3% by full-time workers, 12.2% by unemployed, with 8.1% both self employed and part-time workers, close the housewares with 1% and retirees 0.3%.

Finally, with regard to the frequency of income, it is possible to see that 45.6% have an income below 20,000 euros per year, followed by 37.5% with an income between 21,000 and 40,000 euros, then 12.2% between 41,000 and 60,000 euros, close the table with 3.5% those between 61,000 and 80,000 euros, along with 0.5% and 0.8% of those who earn between 81,000 and 100,000 euros and those who earn over 100,000 euros respectively.

Responsible for spending

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	264	66.8	66.8	66.8
	No	131	33.2	33.2	100.0
	Total	395	100.0	100.0	

Table 8: Responsible for spending table. Source: SPSS output.

Diseases

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diabetes	4	1.0	1.0	1.0
	Obesity	22	5.6	5.6	6.6
	Heart Diseases	2	.5	.5	7.1
	High Cholesterol	13	3.3	3.3	10.4
	None of the above	354	89.6	89.6	100.0
	Total	395	100.0	100.0	

Table 9: Diseases table. Source: SPSS output.

The table titled "Responsible for spending" refers to whether respondents are those who regularly buy products that are consumed at home. 66.8% answered yes, while the remaining 33.2% answered no. In case of a negative answer, the respondents were not given the questions related to the familiarity of purchase with the proposed product.

The last table, instead, refers to whether or not respondents suffer from the reported diseases: diabetes, obesity, heart problems, high cholesterol. The vast majority (89.6%) does not suffer from any of the diseases mentioned, while 5.6% suffer from obesity, followed with 3.3% by those who suffer from high cholesterol, then with 1% those who suffer from diabetes and finally with 0.5% those who suffer from heart problems.

There are no missing answers in any of the tables presented above.

3.2.2 Reliability analysis

After analyzing the above statistical frequencies, the next step of the data analysis is to test reliability, the purpose of which is to validate the scales of the variables with 7-point Likert scale, taken into consideration for the analysis.

As mentioned at the beginning of this chapter, the dimensions used have been taken from previous studies, but it is necessary to validate them again in order to prove that they are valid for the current analysis. So, through statistical techniques, finally, their reliability is measured through Cronbach's Alpha[37].

- Scale: comprehensibility

Reliability Statistics

Cronbach's Alpha	N of Items
.763	3

Item Statistics

	Mean	Std. Deviation	N
Compre_1	4.99	1.411	395
Compre_2	5.34	1.203	395
Compre_5	5.58	1.421	395

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Compre_1	10.92	4.725	.717	.532
Compre_2	10.58	6.275	.563	.721
Compre_5	10.33	5.578	.524	.766

Table 10: Reliability statistics "Comprehensibility". Source: SPSS output.

[37] Cronbach's Alpha is a statistical indicator used to validate the reliability of the scales under consideration. The reference values that are taken into account depend on how many items are used. 0.7 is the value that is taken into account when the items are more than 10, while for items less than 10 is taken as alpha value 0.5. The maximum value that can be reached by the index is 1, the closer the scale gets to this value, the higher the reliability is.

The first scale that has been taken into consideration is that of "comprehensibility". This scale is also part of the sub-dimension that define subjective understanding. The items that are contained within it are: "comprehensibility_1" which measures how well informed the respondent feels about the FOP, "comprehensibility_2" which measures how much the respondent deems the FOP credible and reliable and "comprehensibility_5" which measures how much the respondent considers FOP nutrition information easy to understand, these in the questionnaire measure with a Likert scale from 1 (completely disagree) to 7 (completely agree) the degree of information, credibility and ease of reading that the presented FOP transmits to the respondent.

The current value of Cronbach's alpha is 0.763. Therefore, given the high value we can consider this scale has a good reliability. And also, as already seen with the first scale of the liking, it is possible to notice that the third item "comprehensibility_5" through its deletion would have a higher general Cronbach's alpha, but given the relatively small improvement it is possible not to delete the item. This again makes the scale, with all its items, reliable.

The following items have been inserted in this scale:
Understanding, Moser et al., (2010)
Compre_1: I feel well informed by this label
Compre_2: This label is credible and reliable
Compre_5: The nutritional information on this label is easy to understand

- Scale: help to shop

Reliability Statistics

Cronbach's Alpha	N of Items
.697	3

Item Statistics

	Mean	Std. Deviation	N
HTS_1	4.71	1.596	395
HTS_2	5.38	1.369	395
HTS_3	4.57	1.489	395

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
HTS_1	9.94	5.885	.512	.610
HTS_2	9.27	6.539	.568	.543
HTS_3	10.08	6.610	.466	.662

Table 11: Reliability statistics "Help to shop". Source: SPSS output.

The second scale that has been analyzed is the "Help to Shop" scale, also this is a sub-dimension for subjective analysis. It contains the following items: "HTS_1" which measures how much the respondent understands the composition of the product through FOP, "HTS_2" which measures how much the respondent understands the different nutritional values of the product and "HTS_3" which measures how much the respondent is helped by the FOP to choose foods. They were measured with a Likert scale from 1 (completely in disagreement) to 7 (completely in disagreement), aiming at measuring the degree of understanding that the respondent can draw from the FOP presented in terms of product composition and nutrient content.

The current value of Cronbach's alpha is 0.697, which also makes this scale on a good level of reliability. Also, as it can be seen from the table, none of the three items contained here produces a better Cronbach's alpha with its deletion, so all three items will be retained. And just like before, all items can be considered reliable.

The following items have been inserted in this scale:

Help to shop, Moser et al., (2010):

HTS_1: This label helps me to understand the composition of the product

HTS_2: This label helps me to understand the different nutritional values of the product

HTS_3: This label helps me choose foods

- Scale: complexity

Reliability Statistics

Cronbach's Alpha	N of Items
.719	2

Item Statistics

	Mean	Std. Deviation	N
COMPLEX_1	4.09	1.649	395
COMPLEX_2	4.05	1.745	395

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
COMPLEX_1	4.05	3.044	.562	.
COMPLEX_2	4.09	2.721	.562	.

Table 12: Reliability statistics "Complexity". Source: SPSS output.

The third scale that has been analyzed is "complexity". The complexity re-enters between the sub-dimensions that aim to define the subjective understanding. Complexity contains the following two items: "COMPLEX_1" which measures how much the FOP is seen by the respondent complete with all necessary information and "COMPLEX_2" which measures how much the FOP is preferred by the respondent to be used for evaluations rather than based on their own knowledge. These two items aim at measuring through a Likert scale from 1 (completely disagree) to 7 (completely agree) the respondent's perception of the presented FOP in relation to the degree of information he/she feels when he/she sees it.

In this case the Cronbach's alpha has a value of 0.719, also this has a very good level of reliability. In the analysis of this scale it was not possible to analyze if the items taken could have an improvement of the initial Cronbach's alpha with their elimination, having us only 2 items. Also, in this case is it possible to deduce that all items were reliable.

The following items have been inserted in this scale:

Complexity, Moser et al., (2010)

COMPLEX_1: This label is complete with all the information I need

COMPLEX_2: I prefer to use this label for my purchasing decision rather than rely on my knowledge of food ingredients.

- Scale: liking

Reliability Statistics

Cronbach's Alpha	N of Items
.914	3

Item Statistics

	Mean	Std. Deviation	N
LIKING_1	4.77	1.254	395
LIKING_3	5.05	1.183	395
LIKING_4	5.03	1.173	395

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
LIKING_1	10.08	5.116	.783	.916
LIKING_3	9.79	5.153	.853	.856
LIKING_4	9.82	5.209	.850	.859

Table 13: Reliability statistics "Liking". Source: SPSS output.

The last scale that has been analyzed through the reliability analysis is "liking". The items included in this scale are the so-called "LIKING_1, LIKING_3 and LIKING_4" that measure how the respondent evaluates the submitted FOP. In the questionnaire these items measure with a Likert scale from 1 (very bad / very unfavorable / extremely negative) to 7 (very good / very favorable / extremely positive) the perception that the respondent has of the proposed FOP.

As can be seen from the table above, Cronbach's Alpha has a value of 0.914, so it can be considered with more than optimal reliability.
It is possible to notice, how by deleting the item Liking 1, it is possible to increase the alpha of the scale by 0.02, but given the almost imperceptible improvement of the initial alpha we can avoid deleting the item in order to increase Cronbach's alpha value. From this ia it possible to deduce that all items were reliable.

The following items have been inserted in this scale:
Liking, Allen and Janiszewski, (1989)
LIKING_1: Very good vs very bad
LIKING_3: Extremely unfavorable vs very favorable
LIKING_4: Extremely negative vs. extremely positive

3.2.3 T-test

The last step of the analysis of the results was to conduct an independent sample t-test. The independent samples t-test was performed, as it was decided to compare the averages of two dependent variables normally distributed in a range for two independent groups.

Before launching the test for all intents and purposes, a further step was taken, namely to calculate the overall averages of each scale.
Therefore, using SPSS with the "Compute" function, the averages were calculated by manually entering the items through the formula: "(items_n+items_n+1)/number of items". Thus obtaining the averages of each scale.

After this step, we moved on to formulate the null and alternative hypotheses for the test.

NULL & ALTERNATIVE HYPOTHESES

H0: The mean of the NutrInform Battery is equal or less than the mean of the Multiple Traffic Light. (μ NutrInform $\leq$ μ MTL) in relation to the four above mentioned scales.

H1: The mean of the NutrInform Battery is larger than the mean of the Multiple Traffic Light. (μ NutrInform > μ MTL) in relation to the four above mentioned scales.

After formulating the null and alternative hypotheses, again through the SPSS program, it has been possible to proceeded launching the test, setting the dependent variables: Comprehensibility_mean, Helptoshop_mean, Liking_mean and Complexity_mean. Then defining the group: FOPL(0,1), where 0 represents the NutrInform and 1 the MTL.

Group Statistics

	FoPL	N	Mean	Std. Deviation	Std. Error Mean
Comprehensibility_mean	NutrInform	197	5.2284	1.11486	.07943
	MTL	198	5.3822	1.10548	.07856
HelptoShop_mean	NutrInform	197	4.7733	1.22402	.08721
	MTL	198	4.9933	1.11340	.07913
Complexity_mean	NutrInform	197	3.9264	1.50710	.10738
	MTL	198	4.2071	1.48343	.10542
Liking_mean	NutrInform	197	4.8646	1.13976	.08120
	MTL	198	5.0320	1.08030	.07677

Table 14: Group statistics in SPSS as t-test results. Source: SPSS output.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality ..
		F	Sig.	t
Comprehensibility_mean	Equal variances assumed	.009	.925	-1.376
	Equal variances not assumed			-1.376
HelptoShop_mean	Equal variances assumed	1.317	.252	-1.869
	Equal variances not assumed			-1.868
Complexity_mean	Equal variances assumed	.031	.860	-1.865
	Equal variances not assumed			-1.865
GennAtt_mean	Equal variances assumed	.135	.714	-1.498
	Equal variances not assumed			-1.498

Table 15: Independent Samples test, Levene's statistics. Source: SPSS output.

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Comprehensibility_mean	Equal variances assumed	393	.170	-.15373
	Equal variances not assumed	392.928	.170	-.15373
HelptoShop_mean	Equal variances assumed	393	.062	-.22000
	Equal variances not assumed	389.148	.062	-.22000
Complexity_mean	Equal variances assumed	393	.063	-.28067
	Equal variances not assumed	392.828	.063	-.28067
GennAtt_mean	Equal variances assumed	393	.135	-.16735
	Equal variances not assumed	391.655	.135	-.16735

Table 16: Independent Samples test, t-test for equality of means. Source: SPSS output.

Before proceeding to the core of the analysis it is necessary to check Levene's statistics, which tests the assumption that the variances of the two averages are equal (H0: $\sigma^2_{NutrInform} = \sigma^2_{MTL}$ H1: $\sigma^2_{NutrInform} \neq \sigma^2_{MTL}$).

- Comprehensibility

Group Statistics

	FoPL	N	Mean	Std. Deviation	Std. Error Mean
Comprehensibility_mean	NutrInform	197	5.2284	1.11486	.07943
	MTL	198	5.3822	1.10548	.07856

		Levene's Test for Equality of Variances		t-test for Equality ..
		F	Sig.	t
Comprehensibility_mean	Equal variances assumed	.009	.925	-1.376
	Equal variances not assumed			-1.376

Table 17: Group statistics and Levene's statistics for scale "Comprehensibility". Source: SPSS output.

Since the significance identified by Levene statistics is 0.925 and is therefore greater than 0.05 we can not reject the null hypothesis (H0: $\sigma^2_{NutrInform} = \sigma^2_{MTL}$) and for this reason the assumption of equal variances is encountered. Therefore, for the analysis of the t-test it will be taken into consideration only the data related to "Equal variances assumed".

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Comprehensibility_mean	Equal variances assumed	393	.170	-.15373

Table 18: t-test for equality of means statistics for scale "Comprehensibility". Source: SPSS output.

Among the results of the t-test is it possible to notice that the significance level is at 0.170, and it is not smaller than alpha (= 0.05). We do not reject H0, the difference in the means recorded between the two groups is not statistically significant.
Thus, registered the mean of NutrInform (5.22) and the mean of MTL (5.38) for comprehensibility, with 95% confidence, is it possible say that mean (population) comprehensibility for NutrInform and MTL do not significantly differ.

Mnutrinform = 5.22 (SD = 1.11); Mmtl = 5.38 (SD = 1.10); t(393) = -1.367, p = 0.170 mean (population) comprehensibility for NutrInform Battery and Multiple Traffic Light do not significantly differ.

- Help to shop

Group Statistics

	FoPL	N	Mean	Std. Deviation	Std. Error Mean
HelptoShop_mean	NutrInform	197	4.7733	1.22402	.08721
	MTL	198	4.9933	1.11340	.07913

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality ..
		F	Sig.	t

HelptoShop_mean	Equal variances assumed	1.317	.252	-1.869
	Equal variances not assumed			-1.868

Table 19: Group statistics and Levene's statistics for scale "Help to shop". Source: SPSS output.

Again, for this second variable we retrace the same procedure done before in order to understand if it is possible to reject the null hypothesis posed by Levene's statistic. Since the significance identified by Levene statistics is 0.252 and is therefore greater than alpha (= 0.05) we can not reject the null hypothesis (H0: $\sigma^2_{NutrInform} = \sigma^2_{MTL}$) and for this reason the assumption of equal variances is encountered.

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
HelptoShop_mean	Equal variances assumed	393	.062	-.22000

Table 20: t-test for equality of means statistics for scale "Help to shop". Source: SPSS output.

Taking into consideration, therefore, only the data included in the "equal variances assume" row, is it found that the significance in this case is of 0.062, is greater than alpha (= 0.05). We do not reject H0, the difference in the means recorded between the two groups is not statistically significant.

With 95% confidence, is it possible to say that mean (population) help to shop for NutrInform and MTL do not significantly differ.

Thus, mean of NutrInform (4.77) are not significantly different than mean of MTL (4.99) for help to shop.

Mnutrinform = 4.77 (SD = 1.22); Mmtl = 4.99 (SD = 1.11); t(393) = -0.22, p = 0.062 mean (population) help to shop for NutrInform Battery and Multiple Traffic Light do not significantly differ.

- Complexity

Group Statistics

	FoPL	N	Mean	Std. Deviation	Std. Error Mean
Complexity_mean	NutrInform	197	3.9264	1.50710	.10738
	MTL	198	4.2071	1.48343	.10542

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality ..
		F	Sig.	t
Complexity_mean	Equal variances assumed	.031	.860	-1.865
	Equal variances not assumed			-1.865

Table 21: Group statistics and Levene's statistics for scale "Complexity". Source: SPSS output.

The procedure is performed again for the third scale in question, the complexity. The significance identified by Levene statistics is 0.860 and is therefore greater than alpha (=0.05) we can not reject the null hypothesis (H0: $\sigma^2_{\text{NutrInform}} = \sigma^2_{\text{MTL}}$) and for this reason the assumption of equal variances is encountered.

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Complexity_mean	Equal variances assumed	393	.063	-.28067

Table 22: t-test for equality of means statistics for scale "Complexity". Source: SPSS output.

Also in this case the significance detected by the test, equal to 0.063 is greater than alpha (=0.05). This leads to the fact that the null hypothesis H0 cannot be rejected, the difference in the means recorded between the two groups is not statistically significant.
With 95% confidence, we can say that mean (population) complexity for NutrInform (3.92) and MTL (4.20) do not significantly differ.

Mnutrinform = 3.92 (SD = 1.50); Mmtl = 4.20 (SD = 1.48); t(395) = -0.28, p = 0.063 mean (population) complexity for NutrInform Battery and Multiple Traffic Light do not significantly differ.

- Liking

Group Statistics

	FoPL	N	Mean	Std. Deviation	Std. Error Mean
Liking_mean	NutrInform	197	4.8646	1.13976	.08120
	MTL	198	5.0320	1.08030	.07677

		Levene's Test for Equality of Variances		t-test for Equality ..
		F	Sig.	t
Liking_mean	Equal variances assumed	.135	.714	-1.498
	Equal variances not assumed			-1.498

Table 23: Group statistics and Levene's statistics for scale "Liking". Source: SPSS output.

Also for the last variable the same procedure has been applied. So since the significance identified by Levene statistics is 0.714 and is therefore greater than alpha (=0.05), the null hypothesis H0 cannot be rejected (H0: $\sigma^2_{NutrInform} = \sigma^2_{MTL}$) and for this reason the assumption of equal variances is encountered.

Independent Samples Test

		t-test for Equality of Means		
		df	Sig. (2-tailed)	Mean Difference
Liking_mean	Equal variances assumed	393	.135	-.16735

Table 24: t-test for equality of means statistics for scale "Liking". Source: SPSS output.

Since the significance is 0.135, and it is greater than alpha (=0.05), we do not reject H0, implying that the variable is not statistically significant.

With 95% confidence, is it possible to say that mean (population) liking for NutrInform (4.86) and MTL (5.03) do not significantly differ.

Mnutrinform = 4.86 (SD = 1.13); Mmtl = 5.03 (SD = 1.08); t(395) = -0.167, p = 0.135

mean (population) liking for NutrInform Battery and Multiple Traffic Light do not significantly differ.

3.3 Findings

This study investigates and tests the topic of subjective understanding and liking of the FOP label NutrInform Battery by consumers in relation to the Multiple Traffic Light.
The research, carried out on a panel of Italian respondents reached through the Prolific platform, has allowed to analyze the response of consumers on 4 different categories in terms of energy and nutrients: fat, saturated fat, sugar and salt.
The respondents were randomly assigned to one of two possible conditions: NutrInform Battery or Multiple Traffic Light.
The independent variables chosen for this study are subjective understanding and liking. For a better definition of subjective understanding have been chosen sub-dimensions already tested, such as: complexity, help to shop and comprehensibility (Moser, et al. 2010).
The initial research question is configured in the survey as the measurement of subjective understanding and liking's degree, in relation to the NutrInform Battery and to the Multiple Traffic Light.

The analysis conducted allowed us to analyze the variables taken into consideration, with the aim of confirming our two hypotheses H1(NutrInform Battery performs better than Multiple Traffic Light in terms of subjective understanding), and H2 (NutrInform Battery performs better than Multiple Traffic Light in terms of liking). After launching the survey on the Prolific XM platform and collecting the data, the following statistical analysis was performed on the SPSS software. After having isolated the reference variables for the study and verifying their reliability, we moved on to the independent sample t-test analysis to compare the means of the variables. From the results of the analysis, however, it was not possible for us to confirm the hypotheses H1 and H2, because the comparison between the means of the four variables considered (comprehensibility, help to shop, complexity and liking) was not statistically significant. In any case, other important evidence can be observed. In fact, the study confirmed that consumers exposed to NutrInform Battery and Multiple Traffic Light had a good understanding of the information reported on both FOPs. Based on the means reported by

the variable "Comprehensibility" is it possible to see how the degree of understanding of the two FOPs by consumers was more than optimal, NutrInform (5.22) and MTL (5.38), based on a scale from 1 to 7.

Also consumers exposed to the NutrInform Battery and Multiple Traffic Light believe they have a good understanding of both FOPs, and also they believe that both FOPs will help them through decision making, all this is, in fact, evidenced by the means found, in the case of the variable liking it can be seen how NutrInform (4.80) and MTL (5.03) have recorded a remarkable mean, and the same trend is recorded with the variable help to shop, NutrInform (4.77) and MTL (4.99), always based on a scale from 1 to 7.

Beyond this evidence, from the study it is possible to see how in general, consumers may like a label because of its colour and symbols used, or because they think it is easy to understand or use. Also because: “Liking is an important aspect for acceptability and elaboration” (P. Ducrot, et al. 2015).

Conclusion

Since the beginning of this study, it has been argued that food is not only about sustenance, but it also part of our cultures, capable of being tradition, capable of unite entire peoples. Therefore, as such a powerful tool it has to be known how to manage it well, otherwise it could become a risks for our health.

As evidence of this, it has been reported that global trends on malnutrition are not at all comforting and it is constantly deteriorating. Following an analysis of the current proposals and the commitment of the institutions, the analysis focused on the tool that has the potential to bring the greatest results to fight malnutrition, the front-of-package labels (FOP).

After having described the structure of FOPs in general, and then, specifically the characteristics of the most popular FOPs at this time, the Italian response to the world of FOPs, the NutrInform Battery, was introduced. In the final part of the study the marketing analysis conducted on a sample of respondents was described, comparing the NutrInform Battery and the Multiple Traffic Light.

The study has focused on measuring the degree of subjective understanding and liking of NutrInform and Multiple Traffic Light in consumers. And from that, it was possible to draw important insights into the use and dissemination of FOPs. Consumers have shown a certain favor towards the two FOPs presented, stating that NutrInform and Multiple Traffic Light help consumers in various aspects, in fact, respondents believed that NutrInform and Multiple Traffic Light are easy to understand and that they help them at the time of purchase to understand the nutritional structure of the product they are considering. All this shows that FOPs, contrary to criticism, do not slow down purchasing decisions, but rather allow consumers to make better choices and make more informed and healthy choices. Therefore, imposing itself as one of the most suitable tools for consumers for clarity and ease of use.

In addition to the implications for health, there are several implications from a managerial point of view that can be taken in consideration. There has been much discussion about the benefits that FOPs can bring to consumers from the point of view of healthy choices, but there are also benefits for consumers. Indeed, it has been proven that products with

reassuring nutritional claims have seen an increase in sales (J. Hersey, et al. 2011). Producers who trade their products with claims for healthier consumption can benefit from a first mover advantage. By doing so, other manufacturers will be encouraged to do the same, benefiting the market itself and consumers. Beyond this, producers will be also able to collect more information and data on how to produce and how to structure new products based on consumer demands and trends through FOP (E. Vyth, et al. 2010).

Ultimately, policy makers, having proven the benefit that FOPs can bring to consumers in terms of healthier choices and also being able to take into account the benefits for producers, should consider implementing the measures so that FOPs are more widely adopted, thus contributing to their development.

To conclude, this firm currently has several strengths, but it also has several limitations that may be removed in future research.
For example, although the sample examined in this study had a good representation from a gender point of view, it is more flawed on the fact that it was a sample of interviewees only Italians and more for the majority of students with a high degree of education. Future research, therefore, could expand the sample also in other key markets, such as UK, Germany, France and Spain and try to spread the survey also to consumers who do not have high levels of education. A second important limitation, is due to the fact that the survey was spread only online, in fact the intentions of purchase, the degree of understanding of the product, etc., are factors of great importance that are more noticeable during an offline study, future research should therefore take care to repeat the experiment in presence. Continuing, in this study only some of the dimensions taken into account in the survey were taken into account, so future studies could investigate other dimensions such as the propensity to buy or the attractiveness of FOP itself. Finally, future studies could repeat the experiment, considering other FOPs for comparison with the NutrInform Battery, such as GDA, GDA monochrome, Reference Intake or Keyhole logo, and also consider the possibility, in the future, to include in the next experiments a mediator, who can stimulate respondents towards other outcomes..

At the end of this study, therefore, it can be said that although global trends in NCDs and malnutrition in general are not the most reassuring, several steps have been taken to correct these trends. While FOPs may still have limitations and there are still a number of open debates, they have the potential to improve this situation. Given the great

commitment of the institutions and the growing scientific study, we can only remain confident that these labels will change our eating and shopping habits for better.

Appendix

Annex I: questionnaire, the following section contains the questionnaire submitted to the respondents. Considering the fact that the questionnaire presents the same questions for all the eight conditions, below are, first of all, graphically presented the different conditions, and then the questions taking in consideration only one condition as sample, specifically the zero fat fruit yogurt.

INTRO

Gentile intervistato,
Grazie per aver preso parte a questo studio sul comportamento del consumatore. Durante lo studio, le verrà chiesto di effettuare attività di valutazione e di fornire alcune informazioni su di lei. Per favore legga attentamente le informazioni di seguito riguardanti la sua partecipazione a questa ricerca ed i suoi diritti di rispondente:
La sua partecipazione a questa ricerca è volontaria;
- E' libero di ritirarsi dall'esperimento di ricerca in qualsiasi momento;
- I dati raccolti non saranno identificabili individualmente;
- Lo studio dura circa 11 minuti e verrà pagato al completamento

In caso di domande o dubbi o di revoca del consenso in qualsiasi momento, si prega di contattare Carlandrea Peparini, all'indirizzo carlandrea.peparini@studenti.luiss.it

- ○ Ho compreso le informazioni ed acconsento a partecipare allo studio
- ○ Non ho compreso le informazioni e non acconsento a partecipare allo studio

1.INTRO + comprehension + acceptance YOGURT NUTRINFORM ITA

In questa sezione dello studio le chiederemo di segnalare le sue opinioni su un'etichetta Front-of-Pack specifica.
Le etichette frontali sono strumenti efficaci per informare i consumatori

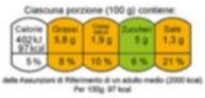
sul contributo nutrizionale apportato da un prodotto alimentare alla dieta. Alcuni tipi di etichette riportano esclusivamente informazioni base sui nutrienti, con particolare attenzione a grassi, zucchero e sale; al contrario, altri tipi di etichette riportano informazioni nutrizionali utilizzando anche simboli o colori (normalmente un semaforo dal rosso al verde).

Tenendo presente questa descrizione e considerando il prodotto seguente: yogurt alla frutta zero grassi, risponda sinceramente alle domande che le verranno mostrate nelle pagine seguenti. – **si prenda il suo tempo per analizzare attentamente la seguente immagine.**


Salsa di
pomodoro con
ricotta


5%
8%
10%
6%
21%


Salsa di
pomodoro con
ricotta




Biscotti
classici


Biscotti
classici


Cracker
di Mais


Cracker
di Mais

Considerando l'etichetta seguente:

	1 Completamente in disaccordo	2	3	4	5	6	7 Completamente d'accordo
Mi sento ben informato da questa etichetta	○	○	○	○	○	○	○
Questa etichetta sembra essere credibile ed affidabile	○	○	○	○	○	○	○
Questa etichetta è accurata e precisa	○	○	○	○	○	○	○
Questa etichetta dovrebbe essere inclusa in altri prodotti alimentari	○	○	○	○	○	○	○
Le informazioni nutrizionali su questa etichetta sono di facile	○	○	○	○	○	○	○

	1 Completamente in disaccordo	2	3	4	5	6	7 Completamente d'accordo
Questa etichetta mi aiuta a comprendere la composizione del prodotto	○	○	○	○	○	○	○
Questa etichetta mi aiuta a comprendere i diversi valori nutrizionali per il prodotto	○	○	○	○	○	○	○
Questa etichetta mi aiuta a scegliere gli alimenti	○	○	○	○	○	○	○
Questa etichetta mi dice cosa comprare	○	○	○	○	○	○	○

	1 Completamente in disaccordo	2	3	4	5	6	7 Completamente d'accordo
Questa etichetta è completa di tutte le informazioni di cui ho bisogno	○	○	○	○	○	○	○
Preferisco utilizzare questa etichetta per la mia decisione di acquisto piuttosto che fare affidamento alla mia conoscenza degli ingredienti alimentari	○	○	○	○	○	○	○
Leggere questa etichetta alimentare richiede più tempo di quanto io sia disposto/a a spendere	○	○	○	○	○	○	○

	1 Completamente in disaccordo	2	3	4	5	6	7 Completamente d'accordo
Questa etichetta mi aiuta a saperne molto sul valore nutrizionale dei prodotti	○	○	○	○	○	○	○

Leggere questa etichetta mi fa sentire un esperto nel valore nutrizionale dei prodotti	○	○	○	○	○	○	○
Posso soddisfare la mia curiosità di conoscere i valori nutrizionali del prodotto leggendo questa etichetta	○	○	○	○	○	○	○
Leggere questa etichetta soddisfa la mia voglia di sapere molto sul valore nutrizionale dei prodotti	○	○	○	○	○	○	○
Questa etichetta mi aiuta a selezionare i migliori prodotti per le persone che sono importanti per me	○	○	○	○	○	○	○
	1. Completamente in disaccordo	2	3	4	5	6	7 Completamente d'accordo
Questa etichetta mi rassicura	○	○	○	○	○	○	○
Questa etichetta mi soddisfa	○	○	○	○	○	○	○

	1. Completamente in disaccordo	2	3	4	5	6	7.Completamente d'accordo
Questa etichetta ha una grafica accattivante	○	○	○	○	○	○	○
Questa etichetta mi attrae	○	○	○	○	○	○	○
Questa etichetta mi invoglia all' acquisto	○	○	○	○	○	○	○

	1. Molto male	2	3	4	5	6	7. Molto bene
Come valuta questa etichetta	○	○	○	○	○	○	○

	1. Estremamente dannosa	2	3	4	5	6	7. Estremamente vantaggiosa
Come valuta questa etichetta	○	○	○	○	○	○	○

1. Decisamente sfavorevole	2	3	4	5	6	7. Decisamente favorevole

Come valuta questa etichetta	○	○	○	○	○	○	○

	1. Estremamente negativa	2	3	4	5	6	7. Estremamente positiva
Come valuta questa etichetta	○	○	○	○	○	○	○

	1. Decisamente inutile	2	3	4	5	6	7. Decisamente utile
Come valuta questa etichetta	○	○	○	○	○	○	○

	1. Decisamente non desiderabile	2	3	4	5	6	7. Decisamente desiderabile
Come valuta questa etichetta	○	○	○	○	○	○	○

Su una scala da 1 a 7, dove 1= estremamente negativo e 7= estremamente positivo, qual è il suo atteggiamento nei confronti dello yogurt alla frutta zero grassi?

Su una scala da 1 a 7, dove 1= decisamente sfavorevole e 7= decisamente favorevole, qual è il suo atteggiamento nei confronti dello yogurt alla frutta zero grassi?

Su una scala da 1 a 7, dove 1= decisamente avverso e 7= decisamente propenso, qual è il suo atteggiamento nei confronti dello yogurt alla frutta zero grassi?

Su una scala da 1 a 7, dove 1= decisamente non salutare e 7= decisamente salutare, qual è il suo atteggiamento nei confronti dello yogurt alla frutta zero grassi?

Su una scala da 1 a 7, dove 1= decisamente non nutriente e 7= decisamente nutriente, qual è il suo atteggiamento nei confronti dello yogurt alla frutta zero grassi?

Su una scala da 1 a 7, dove 1= decisamente nocivo e 7= decisamente non nocivo, qual è il suo atteggiamento nei confronti dello yogurt alla frutta zero grassi?

1. Insapore	2	3	4	5	6	7. Molto saporito
○	○	○	○	○	○	○

Come valuta il prodotto seguente:

1. 7.

Insipido	2	3	4	5	6	Appetitoso
○	○	○	○	○	○	○

Come valuta il prodotto seguente:

1. Sgradevole	2	3	4	5	6	7. Delizioso
○	○	○	○	○	○	○

	1. Completamente in disaccordo	2	3	4	5	6	7. Completamente d'accordo
Se avesse intenzione di acquistare uno yogurt alla frutta zero grassi, sceglierebbe questo prodotto?	○	○	○	○	○	○	○
Se un/un'amico/a stesse considerando un prodotto di questo tipo, gli o le consiglierebbe questo yogurt alla frutta zero grassi?	○	○	○	○	○	○	○

Adesso vogliamo scoprire la sua relazione con la categoria yogurt

	1. Per niente informato	2	3	4	5	6	7. Molto informato
Quanto é informato sui diversi tipi / marche di **yogurt alla frutta zero grassi** ?	○	○	○	○	○	○	○

	1. Una delle persone meno informate	2	3	4	5	6	7. Una delle persone più informate
Come valuterebbe la sua conoscenza dello **yogurt alla frutta zero grassi** rispetto ad altre persone?	○	○	○	○	○	○	○

	1. Sfavorevole	2	3	4	5	6	7.Favorevole
La mia impressione generale dello **yogurt alla**	○	○	○	○	○	○	○

frutta zero grassi è

	1. Negativo	2	3	4	5	6	7. Positivo
La mia impressione generale dello **yogurt alla frutta zero grassi** è	○	○	○	○	○	○	○

Abitudini acquisto Responsabile_Y

Come descriverebbe le sue abitudini di acquisto con gli **yogurt alla frutta zero grassi** negli ultimi 3 mesi?

	1. Completamente in disaccordo	2	3	4	5	6	7. Completamente d'accordo
Ho comprato questo prodotto molte volte nel passato	○	○	○	○	○	○	○
Acquisto abitualmente questo prodotto	○	○	○	○	○	○	○

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Master in Management

Chair Advanced Marketing Management

Executive Summary

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ACADEMIC YEAR 2019/2020

Food has always been synonymous with sustenance and necessity. Throughout history, food has surpassed its simple function as a necessary good for life and it has crossed over into people's culture, their identity, representing a reason for aggregation, celebration. Protagonist in art, culture and even in historical events, how many important pacts have been signed by a banquet afterwards?
Food, therefore, is an integral part of our history and daily life. An element of joy and pleasure, but unfortunately, even food, like everything else, if it is not well managed and administered can represent a danger to our health.
Therefore, precisely for this reason it is necessary to find a method that allows people to be informed and guided towards healthier choices in a simple and understandable way.

This study aims, therefore, at showing the general nutritional trends in order to understand the magnitude of the problem, retracing the commitment made by the institutions in recent years, and then to introduce what, to date, is the best tool to combat poor nutrition: the FOP labels, in particular the latest approved, the NutrInform Battery. Finally, the study will conclude with a quantitative analysis of consumer behaviour in relation to the purchase of products with FOP labels on the packaging, taking into account the NutrInform Battery and the English FOP Multiple Traffic Light.

Chapter I

The first chapter introduces the problem of malnutrition both globally and by macro-areas. The chapter is structured as a review of the relevant literature, presenting first of all the trends on nutrition, and then retracing the steps that the institutions have taken in the battle against this problem. Until the conclusion of the chapter, where FOP labels are introduced for the first time, which will be discussed in more technical detail in the second chapter.

The study begins with the concept of NCDs, or Non-Communicable Diseases, which are diseases that have a very long duration and derive from a combination of factors such as genetics, psychology, personal attitudes and external factors. NCDs are e.g. cardiac ischemia, colourectal cancer, diabetes, etc. One of the great goals of medicine was to understand whether external factors such as personal and dietary habits could be reflected in the rise and development of these diseases. For many years this relationship has not

been proven, but recently by continuing testing they have been able to find a correlation between food consumed and prevention from these diseases.

Precisely in light of the existence of this relationship, it becomes increasingly crucial to understand how to overcome a bad diet. As it will be possible to see soon, with more punctual data, the data concerning the world diet and the number of diseases related to it are increasing compared to the past. This trend is unfortunately justified by several changes, one of them is the change in habits that people have had in recent decades, in fact the hours spent away from home have increased, and the demand for fast and energetic meals instead increased. Often in fact, to ensure efficiency in lunch breaks, are chosen products are not always very healthy. In addition, with the spread of increasingly fast food and the ease with which it is possible to took up on snacks has facilitated the road to an unhealthy diet, even in less adult age.

In fact, worldwide intake of almost all healthy food and nutrients was suboptimal in 2017. The largest gaps between current and optimal intake were observed for milk, seeds and nuts and whole grains. On the other hand, daily intake of all unhealthy foods and nutrients exceeded the optimal level in every part of the globe. Since 1990, the number of deaths attributable to dietary risks considerably increased to 11 million deaths and 255 million DALYs, "disability-adjusted life year"[38], in 2017.

Taking into consideration the entire globe, it has been discovered that the majority of the areas have an insufficient level of healthy food consumption. But still exist some exceptions in which the consumption of healthy food is not below the average. For example, in central Asia the consumption of vegetables is far beyond the average, also legumes in the Carribean, Latin America and south Asia and some part of Africa (such as Sub-Saharan Africa).

Beyond that, it is also important to focus on Europe. In fact, very often, by common thought or other factors, people tend to believe that because of the presence of many countries familiar with the Mediterranean diet (generally considered one of the healthiest), Europe is not in danger of malnutrition. Unfortunately, WHO studies show

[38] It is a measure of the overall severity of an illness, expressed as the number of years death due to illness, disability or premature death

the opposite, in fact from a research by them, has been estimated that 56.1% of the adult population of Europe was overweight in 2010, and the dominance had augmented to 58% in 2014. The study, moreover, predicted a trend for 2025: almost half of the population of all Member States will be overweight or obese (World Health Organization 2013).

Malnutrition, however, although it is a problem that has intensified the most in recent years, has always been a major problem since the post-war period. In fact, over the years, organizations have been formed, and today they have become real institutions that have tried to solve the problem over the decades, thanks to the collaboration between organizations and states to draw up action plans and organize humanitarian aid for the whole world.

Among the many that could be mentioned, the World Health Organization (WHO) and the Food and Agriculture Organization (FAO), are the two organizations that are most prominent in the field of nutrition.

WHO is aimed, for all populations, at achieving the highest possible level of health; it is a member of the United Nations Development Group.

FAO, Food and Agriculture Organization, is the oldest organization affiliated with the United Nations, the starting aim was to support agricultural and nutrition research and to provide technical support to member states to enhance agriculture.

Much as been said about these two organizations above all because through their work they have managed to achieve important goals for the common good of people, collaborating with the institutions in common action plans. One of the most recent examples of this is the case of FAO, which has been supported by the European Union in their Multiannual Financial Framework 2014-2020 and in the 2014-2020 Multiannual Plan, supporting the organization with substantial investments. Also that WHO has proposed to its member countries a list of priorities to be respected in the European Food and Nutrition Action Plan 2015-2020, focusing especially on promoting through official institutional channels the reformulation of products, in order to improve the healthy appearance of products sold to the public and encourage the use of new forms of labelling, such as the so-called Front of Pack labels.

It is precisely on this point that it has been found the tool considered to be the most helpful in helping consumers in the reformulation of products towards healthier and more informed choices: FOP labels.

Internationally FOPs become, in a short time, much appreciated and more and more widespread over the years, still remaining voluntary labels. The reason for the great success of FOPs lies in the great potential they have to combat malnutrition, as well as in their intrinsic benefits for both consumers and producers. In fact, on the consumer side, they will be more aware to follow a healthy diet and not run the risk of health problems. On the producer side, they will be able to obtain more information and data on how to produce new products based on consumer demands and trends through FOP (E. Vyth, et al. 2010).

However, in order for FOP to become a reliable and consistent tool, between countries there is a need for guidelines to be drawn up in order to institutionalize them. This difficult task was entrusted to a special FAO Commission, the Codex Alimentarius. The Codex Alimentarius is a collection of internationally adopted food standards and related texts. Thanks to its achievements over the years and its scientific rigor, Codex has managed to build a strong reputation for reliability, which is why in 2016 the Commission officially takes over the task of drawing up guidelines for FOP labels, now considered the best way to combat bad nutrition.

The reason why Codex supervision had to be used is that creating guidelines for all FOPs is a very complex task, mainly due to cultural and food differences in different countries. Over the years, there have been several debates over which FOPs were the best to adopt, and the debates continue to this day. One of the most recent is the one that involved Italy against France and the UK, both holding their own FOPs. What criticizes Italy against France and the UK is that they have created FOPs that are based on nutritional principles that do not really take into account the balance dictated by the Mediterranean diet, thus resulting, for many Italian products such as parmesan cheese and ham, unhealthy.

For this reason, Italy has decided to develop its own FOP, called NutrInform Battery, which was approved a few months ago. The Italian FOP is based on the principle of portions and not on 100 g consumption, moreover this FOP makes use of strong visual

elements such as batteries that indicate the amount of that nutrient ingested compared to the daily requirement.

Finally, the chapter ends with the introduction of art. 35 Legislative Decree 2011 that regulates the introduction of FOP labels, which will be discussed in more detail in the second chapter.

Chapter II

The second chapter goes into more detail about the major FOP labels in circulation explaining individually their characteristics and differences. Finally, the chapter ends with the specific explanation of the new FOP NutrInform Battery, with its characteristics, merits and defects moved by the critics.

"*People's decisions are always influenced by the way their options are presented to them, and their behaviour is shaped by the design of the spaces in which it occurs*" (Scrinis and Parker 2016). With this phrase, written in the work by Thaler and Sunstein "Nudge: Improving Decisions About Health, Wealth and Happiness", reference is made to the concept of "nudge"[39] and how it should be well calibrated to be a help for people and not to become something too incisive and coercive. This concept refers to how FOPs are also nudges and therefore must be well structured to help consumers and not the other way around.

So the main objective of FOP labels is, therefore, to facilitate understanding for consumers by guiding them towards a healthier choice, also allowing an easier comparison between different products of the same category. With better purchasing decisions made, policy makers and producers have the opportunity to help consumers prevent NCDs and guide them towards healthier and more sustainable purchasing choices for their health (Pomeranz 2011).

[39] Nudge is described as: "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a mere nudge, the intervention must be easy and cheap to avoid. Nudges are not mandates" (Thaler e Sunstein 2008).

In order to analyze different FOPs was used the so-called "Funnel Model". Realized in 2014 by Van der Bend, this model allows to compare the different functionalities and characteristics of the considered FOPs (Van der Bend, et al. 2014).

So, through the use of this Model it will be possible to compare the functional and visual characteristics of the most popular FOPs. The Model recognizes the validity of a FOP system only when there is a combination of different characterizing aspects within a FOP; these are: qualifying components, reference unit, measurement method, coverage, methodological approach, purpose, driver, directivity, tone of voice and utilization. In addition to this first distinction, the model places three other macro-categories that encompasses the aspects mentioned above; the three macro-groups are: "Component", "Methodology" and "Expression". According to experts the last two groups are crucial to study, because they refer to the methodology used for FOP and how the label is presented to the public.

So understanding the criteria and methodology with which they have been developed, it will lead to a deeper understanding of them and how they can influence the choices of key stakeholders such as scientists, producers and policy makers, and the major FOPs analyzed are:

- Multiple Traffic Light

  The first FOP analyzed is the English MTL, which will be the subject of the analysis with the NutrInform Battery. The MTL is a very common FOP in English-speaking countries and is characterized by being semi-directive and making an important visual impact through the use of colours. As a highly valued label, several studies have demonstrated its ability to help consumers choose products containing less sodium or fat (Emrich, et al. 2017). Nevertheless the use of colours is criticized by some as being too "nudging" and too influential for the consumer[40].

- Nutriscore

  Nutriscore, together with MTL, is one of the most widely used FOPs today, developed in France and adopted for the first time in 2017, at the center of the debate with Italy

[40] https://www.horecanews.it/nutrinform-battery-litalia-notifica-la-proposta-del-nuovo-sistema-di-etichettatura-allue/

for its treshold-based food classification method. Nutriscore has five coloured boxes (from green for the most virtuous to red for the most unhealthy), and each one is marked, moreover, by a letter; from A for the healthiest to E for the least healthy. Nutriscore, since are used only colours and letters, without showing any additional information, such as nutrients content and daily quantities required (Askew 2018). Again, and perhaps even more so, the use of colours is criticized, as consumers may understand colours, instead of advice, as an imperative.

- Keyhole Logo

The Keyhole logo is the first FOP developed; it was established in 1989 in Sweden and it was then spread mainly in Northern European countries. This FOP does not present any kind of indication regarding nutrients, but is simply placed as a symbol of guarantee on products that are classified as healthy. It uses the "food-category-specific" methodology and beyond guiding the consumer, it stimulates product reformulation.

- Reference Intake

This FOP has a more unique history than the others, until 2016 in fact it was called GDA, but had the same structure. It has a rather pronounced visual effect, presenting the components and showing in what percentage they are taken when consuming that product. Although the GDA had a diffusion mainly in France and French-speaking countries, at present the RI is also very widespread in Denmark, Greece, Hungary, Holland, Norway, etc. RI aims at guiding the consumer towards healthier food choices, and also encourages reformulation of the product by consumers and producers[41].

As it is therefore visible the panorama of FOP is very wide, for this reason for experts and policy makers it is essential to analyze them and understand their strengths and weaknesses.

[41] https://referenceintakes.eu/index.html

As already mentioned, among the recognized strengths there is the now undoubted ability to represent the best tool to help consumers through healthier food choices. Moreover, they would allow producers to reformulate their products in a healthier way. On the other hand there are still many limitations highlighted by experts. In fact, several studies have brought to light how the lack of uniformity between FOPs is one of their greatest limitations, as consumers who cannot compare FOPs may feel confused to find different FOPs on different products in the same marketplace. And again, the use of colours is often harshly criticized as being too invasive nudging in the minds of consumers, as it has been proven that the use of colours such as "red", which for many FOPs simply means "making a considered use of food," is actually perceived as a ban. Also the very technical FOPs such as Reference Intake are criticized, which reports only factual information, is too complex for some consumers, requiring too long data processing.

In conclusion current patterns are sometimes confusing or unclear to some, while others tend to give too strong nudging in consumers' minds (i.e. use of colours). For this reason, the Italian government, together with other authoritative bodies, has decided to develop its own FOP, which incorporates the advantages of the various categories.

- NutrInform Battery

"*The Italian proposal for a Europe-wide harmonized package face nutrition labelling system. For a conscious choice"*[42].

This FOP is clearly inspired by the already analyzed Reference Intakes. This is particularly noticeable by the fact that nutrients are exposed with numbers and percentages based on ideal consumption. The most noticeable difference is certainly the presence of stylized batteries. In fact, the development bodies of NutrInform wanted to overcome the criticism against RI, according to which it would be particularly complex to understand the information for some consumers, and to include a graphic element. In fact, the battery visually represents the recommended percentage intake of specific nutrients. The use of a colour, strongly criticized in other FOPs such as MTL and Nutriscore, has been excluded. This makes it a rather technical FOP, with the precise aim

[42] https://www.nutrinformbattery.it

of helping consumers by directing them towards healthier diets and supporting product reformulation.

However, even the NutrInform Battery was not exempt from criticism. One of the biggest was from the editorial "Altroconsumo", which condemned the choice of not choosing Nutriscore. Several aspects of NutrInform were criticized, the first of which was that it did not choose to use any colour. The editorial argues that colours help the ability to synthesize information, so NutrInform would have longer reading times to be understood. Secondly, the graphic use of the battery was also criticized because people normally perceive it as a good thing if the battery is more charged than if it is not.
Subsequent studies on NutrInform have then refuted this last criticism, i. e. a pilot study conducted by Professor Mazzù, Professor Romani and Researcher Gambicorti, in which it was tested the degree of understanding by consumers of the use of batteries. The editorial criticized the fact that batteries pass the wrong concept of "the more the battery is charged, the better is", and the results of the study refuted this hypothesis, demonstrating how the vision of a battery is perceived correctly according to the context.

Chapter III

The third chapter, in addition to being the final chapter of the study, represents a focal point as this section presents the model and the experiment designed to measure consumer behaviour, from the point of view of understanding and liking to the NutrInform Battery. The analysis also makes a comparison between the NutrInform and the Multiple Traffic Light.

The study was structured as a questionnaire that was distributed online, through the Prolific platform, in September 2020, to an audience of Italian users only, in Italian language. The valid responses received were 395 and the questionnaire had an average duration of 6 minutes. The design of the questionnaire was in between-subject and respondents were randomly exposed to 2 conditions (NutrInform or MTL) with 4 possible product categories (crackers, yogurt, sauce and cookies), for a total of 8 different stimuli. The two dimensions studied are: subjective understanding and liking. The first, refers to the dimension that allows to measure how the message contained in the FOP is understood by the consumer, as opposed to objective understanding where it is taken into account

only if the consumer has perceived the same message sent by the sender. The liking, instead, allows to measure how a FOP, through all its tools (characters, logos, structure and information) is useful for consumers or not. In addition, two conditions were created for the study, the first with the NutrInform Battery and the second with the Multiple Traffic Light, and these two conditions were then refined to 4 different product categories to show to respondents: crackers, yogurt, cookies and sauce.

The experiment aims at answering the following research questions:
RQ1: What impact have MTL and NutrInform FOP labels on the consumers' subjective understanding of nutritional information?
RQ2: What impact have MTL and NutrInform FOP labels on the consumers' liking?

Finally, it is expected to verify that NutrInform Battery will be more efficient than Multiple Traffic Light in terms of clarity and usefulness in guiding consumers in their purchasing processes. In accordance to the above, the hypothesis are:
H1: NutrInform Battery performs better than Multiple Traffic Light in terms of subjective understanding.
H2: NutrInform Battery performs better than Multiple Traffic Light in terms of liking.

The questionnaire was structured according to the following pattern:

- Introduction, prolific ID, sociodemographic information and product randomization with the corresponding FOP
- Subjective understanding and liking of one of the random assigned product categories

The first part of the questionnaire introduces the theme of the research, in addition to the respondents are asked socio-demographic information, such as age, income, work, whether they are involved in shopping, gender etc. And finally they are exposed to one of the four categories of products with the randomly assigned FOP label clearly visible on top of it.

The second section, instead, aims at measuring the subjective understanding and liking of the FOP presented to the respondent. This section of the questionnaire is particularly

important for the study, as it is possible to measure the data of the two variables subjective understanding and liking.

Finally from the study conducted, the following measures can be inferred:

1) Subjective understanding: As we have already said, it measures the degree of understanding that consumers have of the FOP in question, but in order to measure it, the following sub-dimensions are needed. (Moser, et al. 2010)

a) Comprehensibility
b) Help in the shop
c) Complexity

2) Liking: this dimension evaluates the FOP presented according to the vision of the consumer and his liking (Allen and Janiszewski 1989).

Finally, the collected data were downloaded in Excel format directly from the Qualtrics XM platform and all subsequent statistical analyses were carried out on the SPSS software.

Among the first steps made in the analysis of the results was an analysis of the frequencies recorded among the respondents. Out of 395 respondents a very identifying sample of the population was reached, having recorded 51.1% male respondents, 48.1% female respondents and 0.8% under other. As far as the largest age group is concerned, the 18-24 year-old class was 45.8%, followed by the 25-34 class with 35.2%. The majority of respondents were the students' class (47.1%) and the full-time workers' class (23.3%). In addition, 89.6% of respondents said they did not suffer from any of the proposed diseases (obesity, high cholesterol, heart problems and diabetes), while 5.6% would suffer from obesity and 3.3% from high cholesterol. Finally, among the respondents, the 66.8% responded that they take care of their household shopping.

Including, therefore, the socio-demographic structure of the respondents, the analysis continued with an analysis of reliability of the four analyzed scales (comprehensibility, help to shop, complexity and liking). The analysis showed that all the items contained in

the scales are reliable, and in addition the degree of Cronbach's alpha of all the scales was found to be more than reliable.

Once this phase of the analysis was completed, it was possible to perform an independent sample test. After having grouped the variables and defined the relevant group under the heading: "FoPL (0.1)", in which 0 represented the results obtained by NutrInform and 1 the results obtained by MTL, we moved on to the comparison of the means and their significance. Following the analysis carried out on SPSS, the comparison between averages was statistically not significant for all four variables examined. Nevertheless, other interesting insights can be identified.
In fact, the study confirms that consumers exposed to NutrInform Battery and Multiple Traffic Light have a good understanding of the information reported on both FOPs. Based on the means reported by the variable "Comprehensibility" is it possible to see how the degree of understanding of the two FOPs by consumers is more than optimal, NutrInform (5.22) and MTL (5.38), based on a scale from 1 to 7.

Beyond that respondents exposed to the NutrInform Battery and Multiple Traffic Light believe they have a good understanding of both FOPs, and also they believe that both FOPs will help them through decision making, all this is, in fact, evidenced by the means found, in the case of the variable liking it can be seen how NutrInform (4.80) and MTL (5.03) have recorded a remarkable mean, and the same trend is recorded with the variable help to shop, NutrInform (4.77) and MTL (4.99), always based on a scale from 1 to 7.

From this study we can also draw several managerial implications, because although it was not possible to compare the means of NutrInform and MTL because statistically not significant, it is possible to note that both FOPs have had more than positive feedback, factors that therefore also favor the producer, being able to restructure its products based on the data received from FOPs.
Currently, this firm has limitations; future studies could solve them in a number of ways. First of all, the survey could be disseminated to other core European markets, such as France, Germany and the UK. In addition, FOPs other than those mentioned in this study, such as GDA, GDA monochrome, etc., could be considered. Finally, in this study, only part of the possible variables were analyzed, in the future it could be possible to analyze

other variables such as intention to purchase, the ability of the FOP to understand the nutritional composition of the product or the attractiveness of the FOP itself.