Department of Business & Management; Major: Marketing Metrics & Analytics.

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The effect of nutritional information framing on consumption intention of unhealthy snacks; having product packaging as a moderating variable.

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Introduction

I have always been interested in the topic of nutrition. Since I was pretty young, I enjoyed going for groceries with my mom; soon I noticed I gravitated towards looking at nutritional labels to understand the composition of the food my mom was buying and I started to distinguish among better and worst ingredients. For this reason, this thesis touches significantly my sphere of interest and will be a source of information and new knowledge first of all, for myself. In particular, I will try in the following pages to answer some aspects of this complex topic, which I have been questioning for a long time; and trying to integrate what learned during my studies of consumer behaviour and behavioural economics to the equation to bring a fresher point of view different from the straightforward logical implication often discussed by the science of nutrition. During this months of writing I have been carrying with me the idea perfectly explained by Daniel Kahneman that: "*The world makes much less sense than you think. The coherence comes mostly from the way your mind works.*" (Kahneman, 2011). This concept of creating our own version of the truth made me realize that, especially in the domain of food behaviour, each individual experiences his/her relationship with food in a very personal and unique way. Such belief, raised in me the query of how difficult it is for policy makers to develop a wholesome body of policies which would be effective on all individuals in promoting a healthier lifestyle with regard to food choices. This thesis is a journey towards understating how people read, interpret and act on nutritional labels, and how they consequently determine their consumption intention. In particular, I decided to bring my focus on unhealthy snacks, which should be of greater interest for policy makers in order to control the rising phenomenon of obesity.

The thesis will be divided into three chapters. The first chapter is an introductory chapter which main goal is to investigate the relevance of the topic; it will define the problem to be solved and why this thesis might be somewhat of help to solve such issue. It is a theoretical chapter full of interesting *excursus* on the eating habits and preferences of Italians concerning food. The second chapter is divided into two main bodies. The first part will be devoted to revise the topic of nutritional labels and how they are regulated, the second part will comprehend the literature review based on the theoretical framework of the study. In particular, a wholesome revision of literature works has been performed concerning the difference between food type and food quantity, the effect on nutritional knowledge on food consumption and the effect of portion sizes on energy intake. Lastly, the third chapter will contain the original contribution of this thesis, guiding the reader through the experiment linking labels to intended consumption. The thesis will end with how results should be used in the future to guide policy design and to possible cues for future works of research.

Enjoy the reading.

Chapter 1

1.1 Topic Relevance

Nowadays there exists a disease that is so silent that, more often than not, it is not even considered as such by the general public. Obesity is a worldwide problem and data suggest a steady increase in trend over the past century. The problem is particularly severe in the United States of America, but also Europe suffers from the obesity pandemic. For this reason, policy makers and other institutions understood the importance of a correctly designed body of policies, touching multiple areas of influence, for containing or even battling this problem. Food and its excess consumption are at the base of a matter such as obesity. It seems that people are unbale to correctly perform a quality assessment of the product they purchase and then consume, in terms of health impact. For this reason, a worldwide tool used by policymakers to guide consumption behaviours by providing a wholesome source of information, are nutritional labels. As of now, a great variety of labels are available on the market which as a result created some degree of confusion among grocery shoppers. The reason beyond such heterogeneity in labelling designs, stems from the fact that for a long time their adoption has been unregulated and that the design of some of the parts, even nowadays, is left to the preferences of the producers.

If from one side a multitude of different designs exist on supermarket's shelves, it is also true that a multitude of different responses to nutritional labelling tools has been recorded from individuals. This because each individual is different from one another, and so each person responds to the presence of the nutritional labelling differently. Furthermore, it has been demonstrated that when dealing with food and nutrition, people are affected by a multitude of biases in behaviour which in turn affect preferences and consumption.

For all the above stated and more, it is important for policy makers to find ways to match effectively the presence of the nutritional label and the behavioural response of individuals. This thesis finds its relevance in trying to bring behavioural insights, which might result useful for understanding how individual respond to nutritional information framing, to be a starting cue to adapt nutritional labels policy for health goal purposes. This because, at the end of the day, the goal to achieve is instruct people to consume more wholesome, low energy dense food, and less of the unhealthy processed foods. If nutritional labels, directly or in more unconscious ways are able to guide such behaviour effectively, the battle against obesity might become less of a struggle to fight.

This thesis put emphasis on the fact that often behavioural responses actually move against of what expected following straightforward lines of reasoning, because once again, individual are highly irrational with respect to food choices, and policy makers should be extremely aware of that.

1.2 Italian eating habits

Improving the food system is the main goal of the plan of action 2015-2020 "European food and nutrition"[1] designed by the OMS, in order to promote a healthier lifestyle. In Italy, data on eating habits are collected and recorded by ISTAT as part of the survey "*Aspetti della vita quotidiana*[2]" which collects data on aspects of day to day family life. This database is a precious source of information since data are collected every year between the month of March and May.

Starting from breakfast, Italians seemed improving their breakfast habits in the period between 2001 and 2017. This means that less people are skipping the first meal of the day and more people include some solid food such as bread or biscuits in their breakfast routine. The habit of taking time for consuming a nutritious breakfast is more present in the central and northern part of the peninsula.

Looking at figures, lunch is still the most important meal of the day for 66,6% of the Italian population. 72,8% of the times lunch is consumed at home, thus permitting a better choice of nutrients and ingredients with respect to eating out. Overall the model of consuming a fast lunch on the go is still highly present in all regions. Only 8,2% of Italians claim to consume lunch at work, but the increase in the fast pace rhythms of life increased the percentage of people considering dinner the principal meal of the day (from 20,2% in 2001 to 22,3% in 2017). This tendencies are mostly experienced among men between 35 and 44 years old and among people living in cities and urban areas which are employed in a job.

Fruit and vegetable, according to the INRAN (*Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione*), are considered the most important food sources to promote healthy eating habits. Among their numerous benefits we found the ability to transmit antioxidant nutrients to the body, and reduce the risk of cardiovascular diseases. Five portions a day is the recommended daily intake for fruit and vegetables. In 2017, 75% on Italians declared to consume fruit daily while data on vegetables intake are less positive, only 53,1% of the population stated to consume them daily. Looking at geographical differences, vegetables are most popular in the northern and central regions while fruit is mostly consumed in the south. Consumption is overall below the five portions benchmark. Individuals on average consume between 2 and 4 portions a day, but one fourth of the population recorded to consume only one portion daily, in this case no significant differences arise between regions.

Looking at other nutritional groups, 80% of Italians consume daily carbohydrate in the form of bread, pasta and rice. Consumption of meat shows an increasing trend for young male adults, while remained constant for women. On the other hand, consumption of dairy lost six percentage points between 2011

[1] European food and nutrition plan (2015-2020) Sourced from OMS report: http://www.euro.who.int/__data/assets/pdf_file/0008/253727/64wd14e_FoodNutAP_140426.pdf

[2] "*Aspetti di vita quotidiana*" digital record. Source: https://www.istat.it/it/archivio/4630

and 2017. Positive data have been recorded for consumption of legumes which increased from 44,9% to 54,4%.

Eating according to the Mediterranean diet has recorded overall positive results in reducing the insurgence of chronic diseases. This type of dietary regime is based on the daily consumption of plant-based foods and the sporadic consumption of proteins such as meat, fish and eggs. Study on the adoption of the Mediterranean regime have been performed using the index of adherence to the Mediterranean diet proposed by Benedetti et. Al. in 2016 (Benedetti I., 2016). Results show that adoption to the Mediterranean diet move positively with age and it is mostly used by women. No correlation has been found between the adoption of the Mediterranean diet and the economic status of the family, while some significant correlation was found in relation to the educational level.

After investigating the eating habits of Italians for consumption and their degree of adoption to the Mediterranean diet, I want to add a small digression on their consumption patterns of another category which is particularly relevant during the course of this study, which is the sweet snack category, composed mainly by biscuits, snack cakes and breakfast cereals. Data on such topic were collected by the white paper wrote by IRi[3] in 2016 (IRi worldwide, 2016). In Italy the sweet snack category became popular from the 50s as a great alternative, in terms of conservation, to homemade sweets. Pre-packed biscuits or cake became a love product because of convenience and portability. For these reasons they reach a penetration share of more than 90% appearing in almost all Italian families. The sweet snack category brings 6% of the annual turnover to the fast moving consumer goods industry. Looking in particular at Italian biscuits, their annual turnover is close to five billion dollars, an incredible asset which will, even more, enter the Export market in the following years. The biscuit industry seems stronger than ever with Italian brand such as *Balocco* registering a +2% in 2018. The new frontier for the producers of sweet snack is investing in the so called "healthy indulgence", which is composed by sweet products made with wholesome and healthier ingredients, without renouncing to palatability. In the last few years the trend became very evident for biscuits production. The main brand developed version of their most well-known products made with legume flour or whole-wheat flour or alternatively removing from them unhealthy ingredients such as palm oil or other trans-fat. Figures suggest that in the first quartile of 2019 consumption of whole-wheat biscuits increased by 7,5%.

The market for biscuits and other sweet packaged products seems enjoying some sustained advantages in Italy. Firstly, they match the Italian preference of a sweet and light breakfast; for this reason 80% of the volume of biscuits is marketed thinking about the breakfast meal. Second they are

[3]Data sourced by IRi worldwide 2016: https://www.iriworldwide.com/it-IT/Insights/Publications/Analisi-sui-mercati-di-Merendine-e-Snack-Dolci-nel

not affected by seasonality which make them an all year round product. Third, their target is universal and for this reason brand can play with segmentation strategies to find an appropriate niche of consumers.

Although considered part of the Italian food heritage, packaged sweets, due to their ingredient composition, can also be at the root of developing weight-related issues. The threat of obesity is developed in details in the following pages, building the issues at the base of the relevance of this work.

1.3 The obesity threat

The world is experiencing a continuous rise in obesity in the last decades, which made obesity a true worldwide pandemic. According to the OMS, in 2017 obesity, or more in general overweight conditions cause worldwide 4,72 million deaths, confirming once again the link between obesity and mortality. In the 1990s obesity ranked 16 in the list of the major causes of death, while at the moment it escalated to the 4th position only preceded by high blood pressure, smoke and hyperglycaemia (Obesity Barometer report, 2019). Worldwide there are 2.1 billion people overweight or obese, which corresponds to around 30% of the world population. Projections suggest, that is the trend remains constant by 2030 around half of the world population will suffer from weight problems. Social influences, behavioural norms, evolutionary patterns strongly affect the development of obesity, making this problem extremely complex to tackle and control. For example it has been found that living in territories with a higher obesity index, by itself can increase the risk of increasing the BMI (body mass index). Among the threats existing at the time is that modern life is for many aspects more sedentary than in the past. Estimates suggested that urbanization reduced over time the energy consumption by 300-400 calories per day (Obesity Barometer report, 2019). Looking at consumption patterns, food became overall cheaper in the last 60 years. But looking up close, in particular high processed foods, with low nutritional value are the one which started to cost less, while the price for healthy and wholesome produces remained, controlling for inflation, more stable. This has an effect, particularly on those family living in the lower income classes, which make grocery shopping exclusively looking at the price tag and discounts. All these patterns put emphasis on the importance of the environment in which people live for developing obesity.

All this said, obesity is a serious disease worldwide, with the potential of reducing the life expectancy parameter by 10 years. Apart from mortality, it also deeply affects the psychological aspects of an person's life. Among kids obesity is often the cause of bullying and low self-esteem. Governments and institutions have to devote time and attention to tackle this problem which is so embedded in our

society that has almost become a silent problem. In order to raise awareness, actions must be taken which cover a great variety of industries and circumstances. Great attention should be devoted to the multibillion industry of packed food products, so to make sure that the right messages and inputs arrive to the citizens when choosing their food. I so believe, once again, that a great part of the relevance of this dissertations lies in the long term vision and project of seeing nutritional labels as part of this process of nutritional education with the final goal of significantly reducing the problem of overweight and obesity. Nudging individual in multiple aspects of their life is crucial for affecting such a widespread phenomenon; and nutritional label are an important part of the process, since they are equivalent to an instruction leaflet for food choices. In the following sub-chapters I will investigate further on the phenomenon both at a European and national level.

1.3.1 Obesity: evidences from Europe from the past decades

Obesity is among the major cause of cardiovascular-diseases, diabetes and other chronic diseases, which can lead to preventable morbidity and mortality (Flegal KM, 2012). The number of people which can be considered obese almost doubled from the eighties to present days (Finucane MM, 2011). The nation suffering the most from this increased phenomenon was the United States of America (Austin GL, 2011), in which one adult over three is obese and two adults over three can be considered overweight (Ogden CL, 2014). But, it would be a mistake to consider obesity exclusively an "American" issue. In fact, also in Europe, obesity increased in the last twenty years (OECD iLibrary, 2012). Comparing data on obesity in different countries is challenging because different factors of influence come into play. Among those factors we find age patterns (Bartali B, 2002), economic and social factors (Heitmann BL, 1999) but also the level of physical activity practiced in a person's life (Lindstrom M, 2003). Another big issue which arises is comparing studies obtained from different dataset, carried out using different methods, because of the possible biases in comparison which may arise (OECD iLibrary, 2012). The two most well know survey based studies performed at the European level are the "WHO Multi-national Monitoring of Trends and Determinants in Cardiovascular Diseases" know with the acronym MONICA[4], and the "WHO Countrywide Integrated Noncommunicable Diseases Intervention" also known as CINDI[5] study. Taking as reference the MONICA study a great variety of patterns exist around Europe. Obesity levels range from 7% of the population (recorded on men in Sweden) to 45% of the population (recorded in Lithuania) (Heseker H, 2000).

[4] https://www.who.int/cardiovascular_diseases/media/en/a1_40.pdf
[5] http://www.euro.who.int/__data/assets/pdf_file/0017/240236/e79396.pdf

Overall, the data about Europe are considerably lower than the one recorded in the US which range between 29% and 50% of the population (Wang YC, 2007), but still relevant. Looking Europe up-close it seems that obesity is more present in southern and eastern regions of the union than in the northern ones, such as the Scandinavian countries (Anne Berghöfer, 2008). A fraction of this pattern can be explained by strong lifestyle differences as well as dissimilarities in the socioeconomic status of the populations. When speaking about lifestyle differences, it emerges the importance of living a sedentary versus a non-sedentary lifestyle. In fact obesity in Europe, has been correlated to lack of physical activity linked to a sedentary lifestyle (Martinez-Gonzalez MA, 1999). The inadequacy of the data used to perform these studies is evident when literature shows contrasting result. In fact, the study performed by Silvano Gallus et. Al. (Silvano Gallus, 2015) found the highest obesity rates in Finland (35,4%), the United Kingdom (35,9%) Croatia (36,7%) and Spain (39,2%). This data do not confirm the ones described above, which made a separation between northern and southern Europe, and instead are advocate of the benefits bought by the Mediterranean diet on southern countries for controlling obesity (WHO, 2007); suggesting that those are the countries consuming more fruit and vegetables and less sugar and soft drinks (WHO., 2003), with an exception of Spain which is increasing its consumption of meat and milk, departing away from the Mediterranean diet standards.

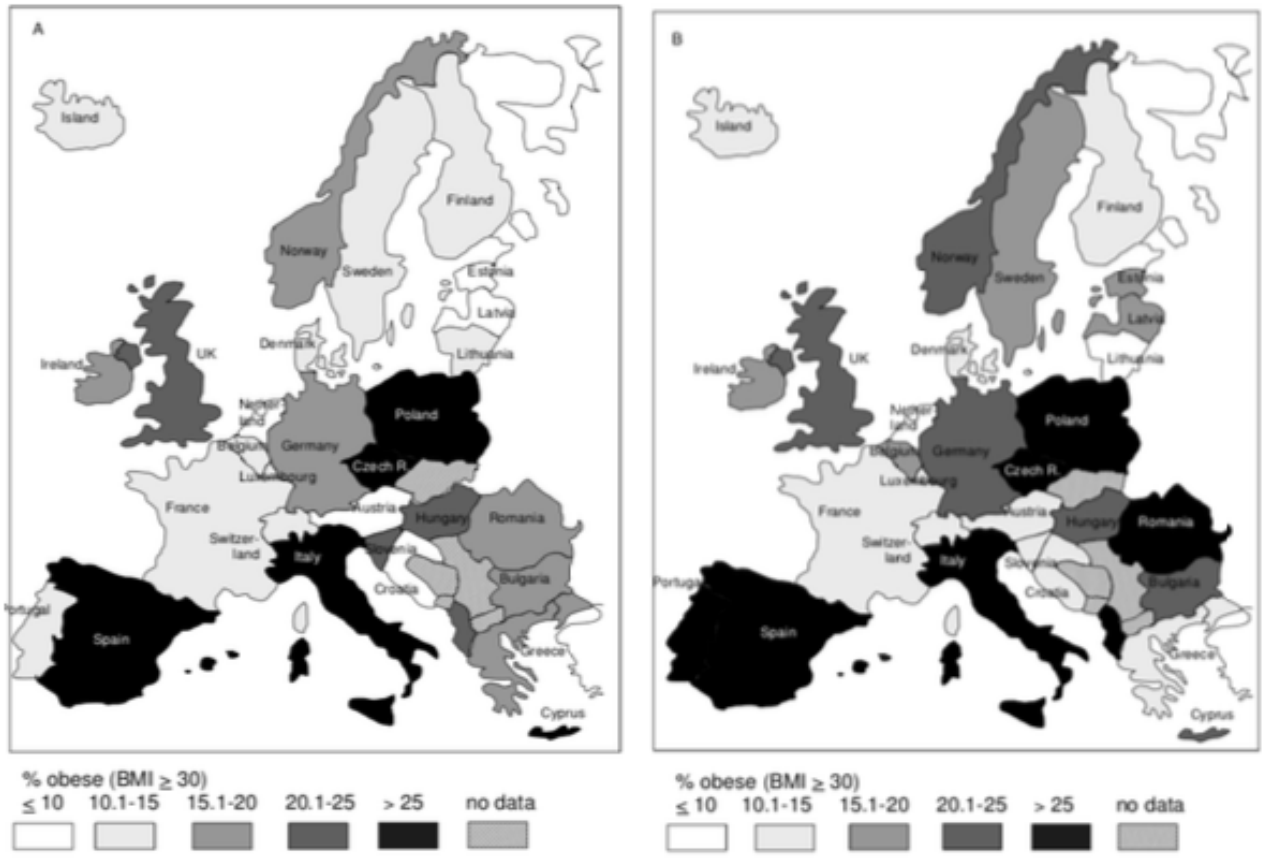


Figure 1.1: Regional variation in prevalence of obesity in Men (A) and Women (B) (BMI ≥ 30 kg/m^2) in men in Europe. **Source**: (Anne Berghöfer, 2008).

Comparing the estimates to those collected in the famous pan-European survey of 1997 (Martinez JA, 1999), increase in obesity varied a lot among member states, resulting constant in some countries while showing increasing tendencies in others. Among the countries registering the worst increases we found France, Ireland and Finland. While the courtiers for which levels of obesity remained constant were Italy and Austria. Looking at the trend at the European level, an overall increase in obesity was registered. Altogether, men have higher possibilities to become obese than women, this difference is not present in the United Stated were obesity rates are similar for both men and women (Flegal KM, 2012). Counterintuitively, higher rate of obesity in women are registered in those countries which overall show lower obesity levels. In Italy for example obesity rates are higher for women than men (Finucane MM, 2011).

Furthermore, in low-income countries, obesity is most present in high-income families, while in high income countries, obesity is found predominantly in lower income families (Monteiro CA, 2004) suggesting the presence of an underlying inverse educational gradient present between educational level and obesity (Gutierrez-Fisac JL, 2012). Some correlation was also found between obesity and smoking, suggesting an increase in the development of obesity after the cessation of smoking. Suggesting that food acted as the element substituting cigarettes (Williamson DF, 1990).

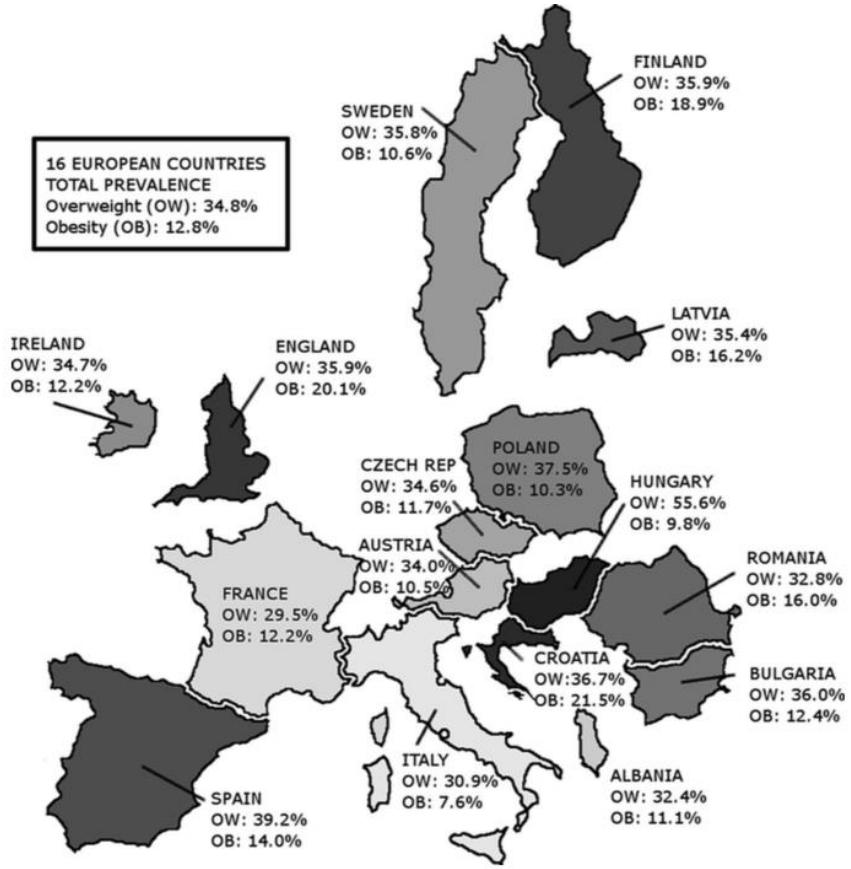


Figure 1.2: Percent prevalence of overweight (25 B BMI \ 30 kg/m^2) and obesity (BMI C 30 kg/m^2) among adults from 16 European countries. Source: (Silvano Gallus, 2015).

1.3.2 Obesity in Italy

Official data from 2015 recorded that 45.1% of the Italian population, having at least 18 years old, was overweight (35.3%) or obese (9,8%)[6]. Obesity has been increasing overtime in Italy, especially looking at males, going from 51.2% in 2001 to almost 55% in 2015. As of 2019, ANSA[7] reported a slight increase in adult obesity reaching 46% of the population, suggesting an increasing, even if slow, trend with respect to 2015 (ANSA, 2019). The total percentage corresponds to 25 million Italians among overweight and obese, among which 23 millions are adults and almost 2 millions are under eighteen. Women are overall less impacted by the phenomenon with respect to men, and the southern regions record the highest obesity rates of the peninsula. This last data are extracted by the first and new "*Italian obesity barometer report*[8] redacted in 2019; which represents a lighthouse suggesting the interest of policymakers, institution, and scientific societies in renewing the interest towards the issue of obesity. Overall policies for contrasting the overweight pandemic had been more incisive from 2005 onwards. As part of the national prevention plan the programme "Guadagnare Salute" promoted the prevention from chronic diseases by advocating for a more active lifestyle and a well-balanced diet. Looking at the pattern with age, obesity seems to increase with age. For both sexes, the majority of cases is in the age range between 65 and 74. A positive figure is the decrease in obesity in the middle age ranges between 45-64 years old.

Consistent with the majority of European countries in Italy, the socioeconomic status of the person might affect the presence of obesity. In particular, families from lower income classes have higher chances of developing obesity. Also the educational level of a person is incidental. In 2017 only 6,6% of individual with a bachelor or master degree showed symptoms linked to obesity compared to 14,2% of people having an high school diploma. This educational gap narrows as age increases. In the time period between 2001 and 2017 the social inequalities linked to obesity and described above had been rising, suggesting that such a disease is more and more correlated with social aspects of a person existence. The presence of obesity in fact increased for low educational levels from 11,9% to 14,2% while remained constant for higher educational level.

As anticipated above, obesity is linked to the development of pathologies such as diabetes, cardiovascular diseases and tumours. Looking at data (Obesity Barometer report, 2019), the proportion of the Italian population showing at least one of these pathologies is 25,4%, looking among obese adults the presence of at least one pathology doubles to 46,3%. Diabetes in particular presents a strong correlation with obesity, in fact 14,6% of diabetics are as well obese. Due to the correlation

[6] All data sourced from ISTAT: https://www.istat.it/it/files//2016/07/EN_Risk-factors-to-health_english.pdf
[7] Data sourced from ANSA: https://www.ansa.it/canale_saluteebenessere/notizie/alimentazione/2019/04/09/.
[8] Data sourced by the Italian obesity barometer report: https://www.diabete.com/wp-content/uploads/2019/04/OBESITY-BAROMETER-REPORT-4-4-2019-LOW.pdf

of obesity with such chronic pathologies, people affected by it risk to compromise the overall quality of their lives. When ISTAT investigated the self-reported quality of life of individuals using the BES indicators (*Indicatori di Benessere Equo e Sostenibile*) designed in 2010, the percentage of dissatisfied individual is higher among obese people with respect to normo-weight people. Looking at the statistics the self-reported quality of life assessment, measured using a 10-points Likert scale, and the BMI of the person are significantly dependent one with the other, at all age levels.

1.3.3 Focus on kids and adolescences.

When investigating the relevance of this dissertation it becomes important to devote some pages to analysing obesity in Italy among the younger generations. This because kids and adolescents are a big target group for the unhealthy snack category and represent a relevant part of their consumers. Furthermore, after comparing figures on obesity in Europe and the United States of America, I want to focus on Italy since the population of this study is Italian. Looking at the data disclosed by ISTAT in October of 2019, in Italy more than two millions among kids and adolescence, between the age of 3 and 17, are overweight. This figure corresponds to 25,2% of kids and adolescences. Overall, even if 74,2% of them eats fruit and vegetables, the quantity consumed almost never reaches the 5 suggested portions a day. On the other hand, one fourth of adolescences consumes sodas and sweet snacks daily, accounting for almost 29% of the population under scrutiny[9]. It is important to analyse data on children obesity because it represents a predictor of being obese as adults. In fact, half of those obese as adolescence will remain obese as adults. In, such a world which is full of temptations regarding food it is more difficult for youngers to operate a degree of self-control over food choices. When looking at data on children southern and eastern Europe register the worst percentage. In Italy obesity is more diffused among boys (27,8%) than girls (22,4%); and the age range with higher number of overweight kids, reaching a peak of 30,4%, is between 3 and 10 years old. Differences also exits between the north and the south of the peninsula. Obesity significantly increases moving south, registering the highest figures in the regions of Campania, Calabria and Sicily.

Patterns have been identified at the family level: kids living in families in which at least one parent is overweight, tend to become overweight or obese as well. If both parents are overweight, kids are overweight as well in 37,6% of the cases. This figure is almost doubled the one of kids coming from families in which none of the parent is overweight (18,8%). Looking at the socioeconomics aspects, a correlation has been found suggesting, once again, that obesity is more present in low-income families, and those in which parents have a lower educational level.

[9] Data sourced from ISTAT: https://www.istat.it/it/files//2019/10/Report_Stili_di_vita_minori.pdf

Among the reasons explaining such figures there is the influence of physical activity. 22,7% of the population between 3 and 17 years old never practiced sport. Luckily this percentage is decreasing over time passing from 47,1% of kids practicing sports in 2010-2011 to 52,5% in 2017-2018. Also for data regarding physical activity the gap between the northern and the southern part of the peninsula is evident. One over four kids does not practice sport in the south. Also here family patterns are very pronounced: if parents are sedentary there is higher chance that their kids will remain sedentary. Education level and economic status have an impact of sport practice similar to the one described above.

Moving back to nutritional practices, while consumption of sugared sodas decreased substantially between 2010 and 2016, going from 31% to 24,9%, consumption of sweets and salty snacks remained almost constant, showing only a slight flection downwards. Nutritional education is learned inside the house. That is why influences of the sociocultural aspects of the household are very prominent. The higher the educational level of parents, the higher the amount of fruit and vegetables consumed in the household by kids and adolescences. Similar pattern apply for consumption of soda drinks and snacks.

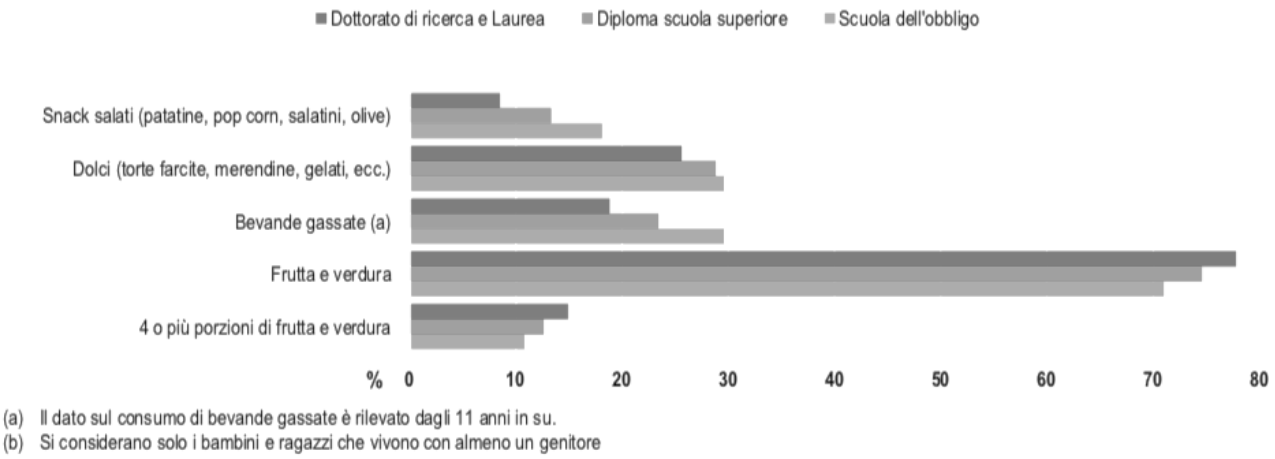


Figure 1.3: consumption of snack, sweets, sodas, fruit and veggies, of kids age 3-17 depending of the parent's educational level. Source: ISTAT.

To conclude, it appears evident the influence of the family background on the nutritional education present in the family unit. Even if data on obesity as of 2018 are still too high in Italy, with respect to other European countries, some small but positive figures have been registered, particularly regarding the amount of physical activity involved in the kids routines, leaving hope for the future.

1.4 The opposite side of the spectrum: restricting eating disorders.

In the previous pages, I have devoted substantial time analysing the presence of obesity in Italy and why this dissertation can have meaningful results on explaining possible behaviours which emerge in relation to nutritional information and food consumption intention; which could then be used as an input to adjust nutritional label policies. But I think it is fair to bring to the surface another aspect which usually is underrated by the literature tackling nutritional labels, which lays at the opposite spectrum of the obesity pathology: restrictive eating disorders. This adds another layer of relevance to this dissertation, also because when we think of a patient affected by a restrictive eating behaviour we think about someone who regularly consults nutritional labels for calorie counting purposes.

Before going on, I believe a small disclaimer is necessary: the topic of eating disorders is very complex and difficult to analyse in few pages (Halmi, 2005), neither it is the scope of this sub-chapter. I only believe that it fair to include both sides of the spectrum in a context in which we define the relevance of a topic closely linked to policy design regarding food cues. And to bring attention to a reality most of the time shaded, because of its smaller size, by the bigger problem of obesity.

A restrictive eating behaviour is a condition for which a person eats less than what is recommended daily, over an extensive period of time. This can develop a proper eating disorder under the form of bulimia, anorexia nervosa or orthorexia. The link between food and body image is stronger than ever in a society which posed great attention to appearance and look. This seems to be especially influential on the younger generation. Estimates suggest that in Italy 10 adolescents over a sample of 100 are affected by some form of eating disorder[10]. The age range most affected by the pathology is between 15 and 19 years old, and the majority are girls. The ministry of health estimates that in 2018 more than 3 millions of Italian suffered from an eating disorder, among which 95,9% are women and only 4,1% are men. Even if the number of people affected by such pathologies is definitely more contained with respect to obesity, it is still a significant number to take into consideration in policy design.

The most evident link between restricting eating behaviours and the use of nutritional information is the phenomenon of calorie counting. It is common practice among people suffering from eating disorders to meticulously count calories on a daily basis. In the last few years a great number of calorie-tracking application have entered the market. Among the most well-known ones we find My Fitness Pal[11] which is a platform to log everything a person's eats in a day for dieting or fitness purposes. A study from 2017 (Simpson, 2017) recorded a significant correlation between the use of calorie and fitness trackers and the presence of eating disorders symptoms. The results suggest that such platforms can result more harmful than not, sustaining unhealthy practices and creating some form of distortion linked to the relationship between a person and food. Nutritional table act as a

[10] Data source by SISDCA (Società Italiana per lo studio dei disturbi del comportamento alimentare) Link: http://www.sisdca.it/html/cnt/home.asp

[11] My fitness pal: https://www.myfitnesspal.com/it/

source of information which can be used for such scopes, for these reasons it is important that the appropriate parameter for the unit figure and especially for defining the right portion size are used and designed or revised, keeping such issues in mind.

1.5 Main contribution of the research

In the last pages, we have investigated in depth the issue of obesity as well as touching the opposite problem of restricting eating behaviours; both those conditions are embedded in today's society and represent a great problem for health and life expectancy of individuals. As well as, both diseases are linked strongly with some psychological and most of the times irrational patterns present in a person's mind. The irrational aspect of individual's behaviour is not a new topic. Food choice decisions, as well, enter greatly the irrational sphere, so that a research has invested in understanding the psychological aspects of food choices and how the environment affects them. Among the environmental factors, things such as the size of the packaging, the lighting of the room, and the presence of others, seem to affect food consumption volumes impressively (Wansink B. , 2006). As for most biases, people often acknowledge they might influence others but often they believe themselves as unaffected, making eating behaviour mistakes difficult to correct. Choosing what and how much to consume is, what is called a low involvement behaviour (Wansink B. R., 1998). Those kind of decisions are often taken instinctively relaying on past anchor or reference points. People often do not realize that on a day to day basis plates, package sizes, serving bowls and even the size of the pantries act as reference point, determining up to a certain extent, how much a person eats. The effect of such cues can increase consumption by 15% up to 45% (Wansink B. , 2006). This increase in consumption happens most of the time without individuals even realizing it. Behaviours which seem foregone, in realty are untrue. In fact, it has been demonstrated that people actually do not know how much they want to eat and cannot recognize when they are full (Wansink B. J., 2009).

From these behavioural studies on food consumption patterns, it is clear that some small nudge or help is needed to aid people with making food related assessments. Among the possible, changeable, aspects of the customer journey of consumers buying for food there are nutritional labels. Nutritional labels represent a source of information which potentially has the power to drive and direct behaviour toward suggesting individual to apply a more cognitive approach to food choice. It is so important to guide judgment because people seem not realizing how much, or how little, they eat; and this as an incredible implication on welfare and living standards.

The contribution this research wants to bring is to provide a wholesome revision of the use of nutritional labels in Europe to asses where we are now. To test, how differences in the framing of the

nutritional information exclusively, affect consumption intentions and lastly to test if controlling the environment by changing the package proposed can successfully control volume intake. Leveraging on nutritional labels is not the only solution to guide food choices but surely it is an aspects policy makers can control to promote healthier eating habits. For this reason, I believe the results of this dissertation could potentially be beneficial for policy purposes to help policymaker, but also food producers to realize possible behavioural patterns stemming from nudging nutritional labels.

1.5.1 Policy side

Confirming the increasing trend of obesity over the past 3 decades, we identified nutritional labels and product packaging as possible sources to leverage in order to nudge eating behaviours. While the dimensions and format of the packaging is mostly chosen by the producer, nutritional labels are a shared effort involving policy decisions at the European or national level and manufacturer's decisions on those aspects of nutritional labels, which can be decided arbitrarily. Hopefully, this dissertation will bring interesting behavioural implication to be used for policy purposes or at least to better understand the different impact, different sources of nutritional information and product packaging have on consumers. Surely, working on preventing and reducing the problem of obesity requires substantial policy effort. A deep understanding of the key determinants bringing this disease is needed. Past policy works recognize diet as the main determinant of obesity (Hawkes C. S., 2015). So an effective food policy is one which succeeded at improving a person's diet. An incredible number of interventions can be used to achieve such a result, among those we also find possible nutritional label nudges, and modification of the environment, such as the pack. When thinking about how this research might be helpful in bringing insights to food policy design some evidences from day to day life have to be taken into consideration:

1) The fact that food preferences determine what people eat, and that those preferences are shaped over the years by the environment in which people live.

   This research will focus exclusively on the unhealthy snack category which for the energy density and the palatability of the products, we believe can become a contributor to the development of over-eating habits. Understanding behavioural patterns on such a product category might be relevant from a policy design point of view. Those food preferences are learnt over the years, for this reason they mostly depend on the eating behaviour of parents, which more often than not are in control of shopping for food products. On a broader level, food behaviour is influenced by culture and social norms. Growing with age preferences are also affected by the marketing efforts of producers and the collection of new sources of information by the consumer. Even if food preferences can changed with time, their nature is

resistant to change. For such reason a good body of policies which support and embrace the promotion of healthy lifestyle choices from a young age could be beneficial in the long run.

2) The barrier faced by people from a low socioeconomic status on accessing and eating healthy diets.

   Those barriers are at the root of the food system in which we live. Empirical evidences suggests that the availability of wholesome foods differs depending on neighbourhoods. Good policies are those able to overcome such problems are supply everyone with the possibility of buying good quality food produce.

3) The price effect of products on purchase intention.

   Individuals are tempted at the point-of-purchase to let go the most expensive alternative. This happens in particular for products which have great shelf competition, displaying different price points. Policy also has to be able to influence the choice architecture of healthier products.

4) Food policies also affect other independent actions inside the food system: those are all the different activities carried out inside the food industry which affect the food environment. Among those we find marketing efforts, and distribution choices. This aspect of policy can have very important implications. For example, when in the United Stated required mandatory disclosure of trans fat information, many producers changed the recipe of the product to reduce the quantity of trans fat used. This kind of policies are able to induce positive responses in the industry.

Nutritional labels are a fundamental pillar of this dissertation; analysing more in depth the effect of policy regarding labels, evidences suggest that the main effect they have was a reformulation of the product made by producers to fit with healthier standards. This effect was stronger than the direct effect nutritional labels have on individuals. It seems that mandatory disclosure of certain nutrients affects diets by forcing food manufacturers, or restaurant and coffee chains, to change the recipe of their products. When looking at the direct effect of food label policies on consumers, policymakers have to find ways for letting costumer respond to new sources of information. To achieve this, it is important to understand behavioural responses of consumers in relation to food labels, then to assess if those are able to encourage consumers to revaluate unhealthy preferences.

Assess the outcome of food policies is challenging for different reasons. Overall, policy actions struggle to succeed for those case in which unhealthy preferences have been already learnt by the individual. In such case, the time span needed for the policy to have some effect will dilute. Furthermore, policy actions will impact different individuals in different ways, making it difficult to come out with a single feedback. Changes in the food environment are also difficult to detect and

identify. Overall a successful policy is one which strategically targets and affects food preferences formation not at the individual level, but in relation to the environment (Hawkes C. S., 2015). This means improving diets both at a local level but also at a global level and among all social classes.

1.5.2 Individual side

In the previous sub-chapter we have dived deeper on how this research might be relevant from a policy design perspective. We have confirmed that in order to combat a problem such as obesity, food policies tackling diet are needed; and a powerful way to drive change is by design policies on nutritional labels, which both have an effect on the producers and on the individuals. The effect on the product manufacturer is easier to define: nutritional labelling policies improve with time the food formula or recipe. At the individual levels improvements are more difficult to detect since each individual is different and affected in different ways by nutritional labels. The environment and lifestyle the person lives affects the degree to which he or she examines labels. Unfortunately it seems that the pursue of an healthy lifestyle or a dieting journey increases the possibility of labels been read and worked upon. In order for policies to be broadly effective, a deep behavioural investigation on how people respond to them is needed. In this way, labels can be modelled and modified to individuals conscious and unconscious needs to improve their effectiveness. Nutritional labels, as will become evident in the second chapter of this dissertation, can be presented in a different multitude of ways. Looking at information for example, it can be presented per 100g/ml of product or per unit of product or even per recommended portion of the product (or as a combination of the three). One of the things this thesis wants to answer to is how people react to different framing of information to see which instigates the right behaviour with respect to that product.

The main driver for the development of obesity symptoms is excess consumption of salty snack or sweets. In general the snack category is the one under the spotlight when policy makers think of ways to control obesity. In fact, obese people seem to abuse of snacks, eating them out from their three main meals of the day. Snack consumption, over a single day, can reach higher energy density intake compared to a normal meal. For this reason I chose to focus on the unhealthy snack category, taking as a reference product sweet biscuits, because I believe the impact nutritional labels can have on such category are more beneficial for obesity prevention policy purposes. Policy makers have also to make sure that nutritional labels are highly visible and comprehensible. During the last decade much work has been done to improve visibility, such as the implementation of FoP labels. On the other hand, for what concerns comprehensibility some issues are still there. It seems that differences in socio-economic status also affect the degree to which a person understands the nutritional table. Those differences should be taken into account as well. Overall, at the individual level this research might,

first of all, shed light on the different types of labels existing right now at the national and global level. This thanks to the wholesome review carried out at the beginning of chapter two. Secondly, the research might be a source of information for people to understand their own behavioural dynamics when differences in the way the information is portrayed are present or differences in the format of the packaging are present. Last, but not least, this thesis might motivate individuals to devote more attention to nutritional labels, and to learn how to see them as powerful sources of information to improve one person's diet. I can surely assess that this thesis has had this effect on me, helping me to make even more conscious food choices.

Throughout this first chapter, we have identify the main pillars which define the relevance of this thesis. Those are the threat obesity which became, over the years, a world pandemic problem. The importance of policy design to improve food choices globally, and nutritional labels as the easiest medium to manipulate in order to make or improve policy designs. In the first part of chapter two, we will deep dive on nutritional labels, exploring the different types present around the globe. Later on, in the second part of the chapter we will review the literature on the behavioural aspects of food choice which will also represent the theoretical background framing the hypothesis of my experiment. In particular, we will investigate different portion biases and the huge effect packaging can have on consumption. The second chapter will start in the following page.

Chapter 2

2.1 Nutritional Labels

As emerged from the first chapter of this dissertation, an important objective for policymakers is to create an environment which enables citizens to sustain healthier choices and promote overall health in their day to day life (Stockley G. C., 2004). A widely applied population approach has been the use of nutritional labels on food produce. Nutritional labels are tables exposed on food packages, stating information about the nutrients inside that particular product. There exist two macro-categories of nutritional labels. Namely "**Nutrition Facts Tables**" and "**Graphical Nutrition Labels**" (Hawkes C. , 2010). Nutrition facts table, popularly called NFT are the most widely used and the oldest ones. They are "box tables" which contain the amount, usually expressed in grams, of the nutrient found inside the food. On the other hand, Graphical nutritional label, or GNL were invented more recently, they rely of graphs or images which make those labels interpretative by nature. NFT are found on the back, or alternatively on the side of the packaging. The box table includes (from left to right), the name of the nutrient, the amount of the nutrient inside the product (usually expressed per 100g) and, in some cases the "percentage of daily value". This last figure is inserted in order to help consumers to place that particular product inside their overall diet. The "**percentage of daily value**" is the percentage of a particular nutrient contained in 100g or in a portion of the product. In order to correctly assume that nutrient, you should achieve 100% of its intake at the end of the day. Great variances from the recommended value might affect overall health in the long run. A crucial concept of Nutritional Fact Tables is the one of "**Reference Unit**". Using reference units makes the information more customer friendly and permits comparison between food from the same product category or even of different ones. Three types of reference units exists:

1. **Per 100g/100ml**: the presence of the information for 100g (in case of solid food) or 100ml (in case of liquids) is mandatory since 2016. This figure is most important to permit direct comparison between products belonging to the same or to different product categories.
2. **Per serving**: the information expressed per serving shows how many grams are included in a typical serving of that food. This is of aid for the consumer to understand how much of a nutrient is present in a serving, as well as the amount of energy provided by that serving. Usually if the producer decides to include this type of information it also discloses the number of servings contained inside the pack.

3. **Per recommended daily amount**: this last reference unit links the nutrient content to the ideal intake of a particular nutrient. It is never shown alone, but always paired to at least one other reference unit.

Graphical nutrition labelling was introduced many years later with respect to NFT. The idea of including graphics stemmed from the problem that consumers seemed not understanding easily NFT, especially at the point of purchase. Reasoning on this problem the aid of graphics seemed a great way to make readability of nutrients more customer friendly. The use of graphics helps to see, read, interpret and act on the label. These type of labels are also known as "interpretative labels". Contrary from NFT they are usually found on the front of the pack, emphasizing even more their visibility. The increasing importance of this format of labels, known as Front-of-pack labelling, has started an entire new stream of research on their effectives. Four type of graphical nutrition labels are the most common around the world: traffic light labelling (very popular in the UK), Guideline Daily Amount (GDA), Nutri Score system (adopted in France), Health star rating system (developed in Australia) and lastly calorie labelling which we will discuss in more details in the following pages.

Nutrition Facts

Serving Size 1 cup (228g)
Servings Per Container 2

Amount Per Serving	
Calories 250	Calories from Fat 110
	% Daily Value*
Total Fat 12g	18%
Saturated Fat 3g	15%
Trans Fat 1.5g	
Cholesterol 30mg	10%
Sodium 470mg	20%
Total Carbohydrate 31g	10%
Dietary Fiber 0g	0%
Sugars 5g	
Protein 5g	
Vitamin A	4%
Vitamin C	2%
Calcium	20%
Iron	4%

*Percent Daily Values are based on a 2,000 calorie diet Your Daily Values may higher ot lower depending on you calorie needs.

	Calories	2,000	2,500
Total Fat	Less than	65g	50g
Sat Fat	Less than	25g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrates		300g	375g
Dietary Fiber		25g	30g

Figure 2.1: Example of a nutrition facts table: United States. Image provided by the Food and Drug Administration (www.fda.gov). **Fao -** Government and voluntary policies on nutrition labelling: a global overview.

The scope of nutritional labelling is the one to supply consumers with information regarding the nutrient content of food in order to make more thoughtful nutrient choices and purchase decisions. If one the one hand, nutritional labels represent a tool useful for consumers inside groceries stores, on the other hand they work as a primary source of consumer protection. In fact, consumers are endowed with three fundamental rights regarding the food they consume: that the food is safe to eat, the origin of the product and its nutrient content. Their effectiveness therefore depends on consumer's use of the information which starts by the search of the information itself (Stigler, 1961) and it is followed by its evaluation with the goal of making decisions (Senauer, 1991). Even if an extensive body of law exists regulating nutritional information, as of now the real challenge for policy makers is to motivate individuals to devote attention to them, and to promote the importance of nutritional knowledge. Following this idea nutritional labels should be ideally supplemented by some form of nutrition education strategies. In the real world though, they still sometimes represent the only usable source available for consumer at the point of purchase. For this reason, it is of vital importance that the information is displayed in the clearest and intuitive way possible in order to guide decision. Developing further, the problem of defining what determines the understating of the information arises. To make sure that a person gets the meaning of the nutritional table he or she has to recognize the nutrient term and its measurement unit, understand the relationship between the different nutrients and their contribution in terms of general health on the body. In order to make these judgements, individuals are called to assess what can be defined as an high vs. low amount of nutrient, translate the information in the context of a given meal choice and calculate the amount of nutrient given in a serving. As a general consequence some individuals might find themselves overwhelmed at the point of purchase ending up to ignore the table all together. In fact, it has been assessed that often the format of nutritional tabled doesn't fully meet the need of shoppers. In the following paragraphs we will first review the regulations concerning nutritional labels and then investigate the relationship between labels and people both at the point of purchase and later on at home.

2.2 Legislation on nutritional labels

An extensive body of law exists regulating nutritional labels. General international guidelines have been designed so to ease trade, in what is known as the "Codex General Standard for the labelling of pre-packaged foods" (FAO, 2001). In Europe the Council Directive (90/496/EEC)[12] of 1990, was implemented by all member states. The directive regulated nutritional labels both for packed food

[12] Council Directive 90/496/EEC on nutrition labelling for foodstuffs of 24 September 1990. Official Journal of the European Communities L276 of October 1990. Luxembourg: European Commission, 1990; 40–4

and for caterers. According to the 1990 directive, nutritional labels are compulsory every time a nutritional claim is made. On packages two types of labels are accepted, called respectively the "Big 4" and the Big 8". The first groups: energy values, amount of fat, proteins and carbs. The latter instead groups: energy values, protein, carbs, sugars, fats, saturates fats, amount of fibre and salt (sodium). For both groups units for measurement and formats must be used. In the year 2000 the updated directive was disclosed, namely Council Directive 2000/13/EC [13]. The directive stated mandatory disclosure of nutritional information of 6 fundamental nutrients: fats saturates, carbohydrates, sugar, protein and salt. Information must be presented per 100g and 100ml[14]. Together with the information per 100g, the manufacturer can voluntarily disclose the same information per unit of product and/or per portion. The information must be presented in a table which resides in the same field of vision of the individual. Usually for this purpose the back of the pack is preferred. Information of the front-of the pack, remains voluntary as well as information regarding other nutrients such as: fibre, starch, polyunsaturated and others. The minimum size of the font, as imposed by Directive 2000/13/EC is 1.2 millimetres, which is reduced to 0.9 millimetres for packages with a surface below 80 centimetres squared. Furthermore, the presentation of additional information in the form of slogans or claims must be presented in a way that doesn't impinge the readability of the mandatory information. Some exemption exist such as labels placed on unprocessed foods or any items for which the information isn't considered a determinant factor affecting buying decisions or which packaging is too small to showcase the nutritional table.

2.3 Nutritional labels and people

Nutritional labels are merely useless if taken out of the context in which they operate. The relationship between the people reading the labels and the label itself is crucial in defining their scope. It has been assessed that often the format of nutritional tabled doesn't fully meet the need of shoppers. The reason for such misalignment is that tables are mainly the outcomes of legislative requirement rather than being thought solely as an aid to consumers. A great variety of studies over the years tried to assess consumer understanding of nutritional labels. A reoccurring result from those investigations is that the majority of people reported finding nutritional tables confusing even if they could understand the meaning of the words inside the label such as "calories" or "fats". The concepts most challenging to understand for people were the link between calories and energy, the connection between sugars and

[13] Directive 2000/13/EC of the European Parliament and of the Council of 20 March 2000 on the approximation of the laws of the Member States relating to the labelling, presentation and advertising of foodstuffs
[14] Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers

carbs or sodium and salt, as well as the term fatty acid (Stockley G. C., 2004). In particular, it was found out that even if they were able to read thorough the table correctly they could not figure out the effect the different nutrient levels had on their diets. Another obstacle which emerged from research is the ability of people to convert the 100g information to the appropriate amount per serving at point of purchase.

In general, looking at the demographics, older people, individuals from lower educational levels or in the lower classes of income find it harder to read and interpret the label. Overall, the only way in which nutritional labels result surely not useful is if people do not read them. Studies find out that the majority of consumers claim to consult the nutritional reference table more often than not, or at least sometime. For some of them looking at the label actually influences the purchase decision of the product at hand. This was found to be particularly true for products which are unknown to the consumer at the point of purchase. People which affirm not to read nutritional label, assign the fault to lack of time, the size of the font which is too small to be easily understandable and even doubts about the accuracy of the information portrayed. Some other studies, using more objective methods, different from self-reported information, suggest that even if people look at the information they often seem not to process the information any further (Higginson C, 2002). In general men were less interested than women in reading nutritional panels and, among women those more interested in reading nutritional labels are those from higher income classes and with higher levels of education. This findings were confirmed by Ollberding (Ollberding NJ, 2010), which together with his colleagues demonstrated the existence of sociodemographic patterns associated to the reading of nutritional panels, namely being a woman, Caucasian, with a high level of education and coming from a mid-high income class. Going even more in depth, older in age and living by herself. But this data on gender, have to be taken cautiously, considering the evolving role of men in the household (Rodolfo M. Nayga, 1998).

Going beyond demographics, people cooking often food at home seemed to read more nutritional labels as well as people who care about their physical appearance, and for this reason practice a great amount of physical activity (Christoph MJ, 2016). This because healthy behaviour in general, forms a cluster so that if you exercise a lot you will be motivated to look and nutritional labels and perform other activities link to the pursuit of health. The three most looked nutrient components are total calories, sugar and the recommended serving size. Frequency of looking at these components changes between men and women. Overall, it was also shown that individuals self-reporting reading nutritional label were the ones consuming more fruit and vegetables as well as fibres (Graham DJ, 2012).

Another curious pattern was found looking at age groups. The sample used by Project EAT-IV[15] exclusively consisted of people between the age of 25 and 36. The sub-group of individuals between 31 and 36 years old showed less interest in reading nutritional panels with respect to the sub-group 25-31. The reason beyond this might be the symptoms of a brutal shift in life circumstances: individuals in the range 31-36 might have started a family, thus buying food for their partners and children. This trend aligns with what found in previous bodies of literature that people living alone devoted more attention to nutritional fact panels (Ollberding NJ, 2010).

Recently, the link between parenthood and the use of nutritional labels has been investigate further. A study performed in 2017 by Kim, Imai, and Mathews (Kim Juhee, 2017), showed that pregnant women were very likely to use nutritional labels with respect to non-pregnant women. The result was significant after controlling for the economic status, health and weight of the person. Other literature on the topic states that parenthood and bad eating behaviours might be related (Laroche HH, 2007). On the other hand, contrasting studies suggests that being a parent motivates the individual to prepare healthier foods for his/her household (Bassett-Gunter RL, 2013). This suggests an overall lack of agreement on the topic.

Other studies suggest that, the recurrence of the use of nutritional labels is linked to weight control goals (Bleich SN, 2015). Contrary no significant link was found between the use of nutritional fact panels and weight status; suggesting the purely motivational aspect of consulting the labels. In the last decade, a great concern was posed by the obsessive analysis of nutritional panels by people showing excessive desire to control calories intake risking the development of an eating disorder (Laz TH, 2015). The link between nutritional panels and the development of sick eating behaviours should be further investigated.

The great majority of mistakes stemming from the reading of nutritional labels arises from the impossibility to compare the nutrient content presented in the label with the recommended intake level for an individual. Overall, the use of some verbal cues, such as words working as descriptors, might increase evaluation accuracy. In the same manner, individuals could correctly judge the overall healthiness of a product if some form of benchmark was presented, such as the percentage of dietary reference values. Individuals could use numerical tables to correctly compare products from the same category (Sullivan AD, 1995). Some respondent admitted they often use one single nutrient, for example sugar, as the anchor to assess the healthiness of the product (Black A, 1992). Several studies tried to understand if people were able to perform simple calculation from data inside numerical tables. Results indicated that even if individual could successfully perform simple calculus, accuracy

[15] **Project EAT-IV:** Eating and Activity in Adolescents and Young Adults. Neumark-Sztainer, Dianne R. University of Minnesota Twin Cities, Minneapolis, MN, United States.

drastically decreased as the complexity of the task increased. Some of those studies suggested the use of charts (pie charts, bar charts) as an aid in performing typical calculations even if the accuracy of the calculus sometimes decreased[16].

People following special diets seem to spend more time reading nutritional labels. The portion of them having some diet related disease states that reading nutritional labels is of great benefit. Furthermore, it was found that the more time an individual spends inside the grocery store the higher the possibility of him/her taking attention toward nutritional tables. As well as, individual devoting a lot of attention on the price of products will spend less time reading nutritional labels, and they will finalize the purchase based on price comparisons.

Overall, five different handicaps have been found (R. J. Lenahan, 1973), which distract individuals from giving attention to nutritional labels. First is the complexity of the theory of human nutrition, which also changes with the evolving needs of the person. Second, in order to acquire proper meaning the person has to have a relatively high level of knowledge. At least the person need to know how the four basic groups (carbs, proteins, sugar, fat) affect the human body. Third, consumers are impaired by the limited amount of space devoted to nutritional labels which makes the reading more challenging and force to present the information in a very summarized manner. Fourth, in supermarkets consumers are constantly exposed to a great amount of stimuli, such as promotional messages, music and chattering of people, and smells. For this reason it is not easy to let the consumer be focused on reading and understanding the nutritional label. Lastly, at the point-of-purchase buying decisions are much affected by impulsive behaviour or other variables such as price considerations, time-saving or repetition of a purchase because of habit.

The use of nutritional labels can have the power to create a new form of competition in the food and beverage industry. Nutritional labels, are a medium for producers to signal the quality of their product, or the presence of certain specific nutrient which the competition does not include (McCluskey, 2003). In fact, producers might be willing to increase the healthiness of their product in order to gain market share against the competition. In this way the nutritional content of products becomes a real driver of competition dynamics. Many brands, in fact, started advertising their products leveraging on nutritional basis. Including nutritional claims inside mass advertising can actually help consumer becoming more nutrition sensitive and attentive (Supermarket News, September 20, 1971). Labels also shift the focus from more naïve aspects such as packaging to more functional ones in order to attract even more the attention of consumers.

[16] British Market Research Bureau. Consumer Attitudes to and Understanding of Nutrition Labelling: Quantitative Stage. London: Consumers' Association, 1985.

2.4 Front-of-Pack nutritional labelling

In the last decade, in order to further help consumer to read with more ease nutritional information, FOPs (front-of-pack) labels were developed. Those, with the help of colours and/or summarized information, help consumers in making food quality assessments at the point of sale. Another indirect benefit obtained by FoPs is that they work as incentives for manufacturers to reformulate their product ingredients, as anticipated above, in a way to increase their health rating, thus resulting less harmful for the product's costumers (Manon Egnell, 2018). Over the years a great variety of different FoPs have emerged around the world. In particular they had been categorized by past literature as "Nutrient-specific labels" (Multiple traffic light, RI) and "Summary FoPs" (HSR, Green Keyhole) (Manon Egnell, 2018). The firsts represent summary tables which allow to assess overall nutritional quality. The latter are endorsement symbols stamped exclusively on products which are considered healthier. Given the vast number of diverse FoP systems, past research has investigated a lot on which was the most easily understood among the most well-known labels, namely the Australian "Health star rating", the "Multiple Traffic Light" in UK, the Nutri-Score in France, the RI and different Warning symbols. Although, consensus on the best FoP is far to be reached. Generally, literature agrees that Front-of-package labelling is perceived favourably as good at increasing awareness towards the healthiness of different products (Stockley G. C., 2015). Overall, interpretative FoPs outperform non-interpretative systems (P. Ducrot, 2015), and multiple works of research recognize the French Nutri-Score as the easiest to interpret regardless of the socioeconomic and demographic status of the individual (Francisco Goiana-Da-Silva, 2019). In fact, the Nutri-Score manifests the most robust evidence toward incentivise healthier consumption for consumers with unhealthier heating habits (P. Ducrot, 2015). The positive results recorded by France implementing the Nutri-Score led Spain and Portugal to follow their example from the year 2018.

On the other hand, different streams of literature sustain that a strong dichotomy exists in the effective evaluation of labels containing different degrees of information (Charo Hodgkins, 2012). In particular, some participants show strong preferences toward higher level of information while other prefer the more direct approach of health logos (HL) or the Nutri-Score. Reading through research articles, is evident the existence of a trade-off between the ease of comprehension of the FoP and the precision and accuracy of the information displayed. People gravitate their preferences toward different degrees of information depending on their preferred thinking style (heuristic vs. systematic) and on the context they find themselves in (S. Gerrier, 2010).

All-embracing, even if findings suggest that, when FoP labels are present, those are seen and processed by consumers when evaluating the product (LP. Hamlin, 2015); their ability to influence

consumption is still considered limited. Furthermore, research has discovered that the use of FoPs decreases the attention devoted to "nutritional fact panels" (NFP) (Bix L., 2015), which represent a more wholesome source of information. For what regards product consumption most outcomes from past literature result not statistically significant, suggesting that knowing what is healthier doesn't translate necessarily into healthier behaviours (Lina Ikonen, 2019). In fact, people might be tricked by the "unhealthy=tasty" intuition, which seduces consumers to avoid the healthy option in favour of the unhealthy, but tasty one (Raghunathan, 2006).

Looking at the other side of the spectrum, literature also identified some possible negative effects which the FoPs might cause. The Halo effect refers to consumers' use of limited and incomplete information to make inferences about the product overall healthfulness (Burton S. C., 2014). Another drawback is that FoPs are still implemented on a voluntary basis in most countries (R. Kanter, 2018), which might generate a distortion in perceptions among different foods or product categories. As of now, big multinationals such as Nestlé are calling for the development of an international agreed-upon format (Askew., 2018), and the lack of consensus among countries and disagreement on which is the most effective FoP to use has lit the debate in Europe.

2.5 Types of Front-of-pack labels

2.5.1 Traffic Light labelling

The traffic light model for labelling was first introduced in 1992 in the United Kingdom by the *Coronary Prevention Group*, a charitable NGO which aim is to prevent heart diseases by promoting the implementation of an healthy lifestyle. This approach cached the attention in 2005 of the FSA (*Food standard Agency*) after different work of research shed light on the difficulty of individuals in reading and elaborating nutritional information. In 2006, the FSA agreed upon 4 key elements of traffic light labelling, designing a consistent approach new to the public. The first element is to provide separate information on the key nutrients: namely fat, saturated fat, sugar and salt. The second element involves the role of colour to provide rapid information about le level of a specific nutrient inside that product. Red, amber and green respectively for high, medium and low level of the specific nutrient. The third point is the specification of the grams of a given nutrient contained in a portion and lastly the strict use of nutritional criteria designed by the FSA to assign the appropriate colour. In particular, those criteria were thought of by taking as a point of reference guidelines created by an independent groups of government advisors; such as the "*Scientific Advisory Committee on Nutrition*" (SACN).

In particular, the range for the green colour was determined by the European regulation (EC) No1924/2006[17] on nutritional health claims. Since the power to regulate nutritional labelling is at the European level, the adoption of the scheme is on a voluntary basis, depending on the willingness of the manufacturer. This caused the birth of a great variety of traffic light designs around the UK. A possible drawback identified by experts was that the use of colour immediately creates a polarizing impression of either "good" (associated with the colour green) or "bad" (associated with the colour red) of the product, which might result too simplistic for something complex such as food. In fact, the red label might signal to people that they should avoid the consumption of that food at all costs, for their health. But sometimes the red labels should be interpreted as a warning to take a closer look at the ingredient list to properly check its source.

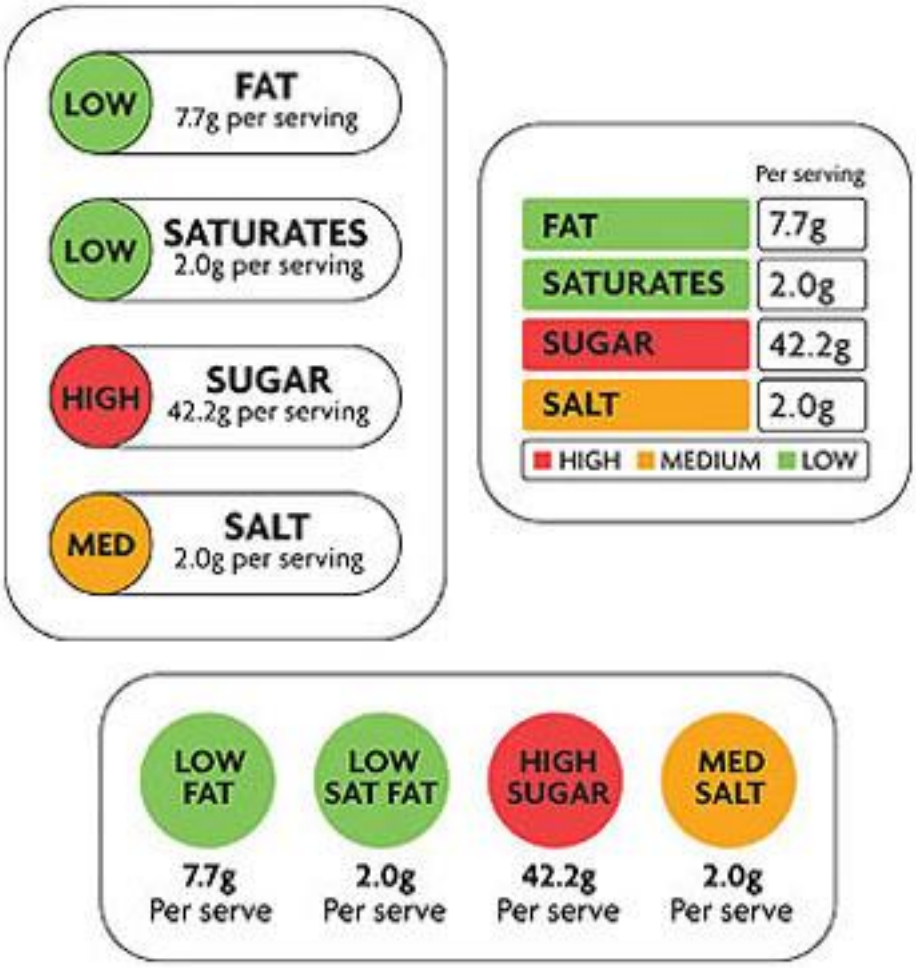


Figure 2.2 Traffic light labels from the United Kingdom. The labels use the following colours: red = high; yellow = medium; green = low. Images provided by the Food Standards Agency (www.food.gov.uk). **Fao** - Government and voluntary policies on nutrition labelling: a global overview.

[17] Document source: https://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:404:0009:0025:EN:PDF

2.5.2 Guideline daily amount labelling

The idea of creating GDA labelling came after identifying the possible drawbacks of the traffic light system. The Guideline Daily Amount model was thought and developed by the "European Food Industry". The system is designed to represent the amount of energy (calories) and grams of nutrients found inside a portion of the product as a percentage of the "Guideline Daily Amount". The latter is the ideal amount a person should consume in a day of eating of any nutrient. This kind of label is both a back-of-pack label and a front-of pack label. A more wholesome label appears at the back of the pack and the summarized translation in percentage of GDA is included at the front. The graphic look of the "Guideline Daily Amount System" is the one of a "thumbnail". This type of label became very popular all around Europe and was adopted voluntary by many brands in France, Italy, Spain, the UK and the Netherlands. In particular, according to the survey instructed by the CIAA (*Confederation of the food and drink industry*) in 2008, 44% of responding brands were using GDA labels on their products. Furthermore, many supermarket chains, such as Tesco (Uk) and Lidl have designed their own GDA labels to put on their branded products as a way to generate a competitive advantage. The systems also expanded outside Europe, arriving in Australia with the name of "Daily Intake Guide". The idea to introduce such a scheme was of the "*Australian food and groceries council*" (AFGC) in 2006. Versions of the GDA are also present in the United States and in Canada.

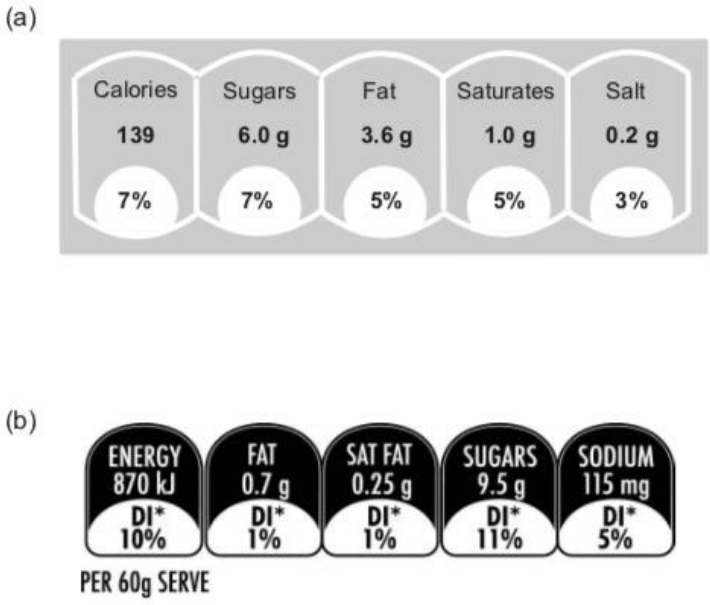


Figure 2.3 GDA nutrition labels. (a) CIAA scheme. (b) Australian Food and Grocery Council Daily Intake Guide. Images provided by the Food Standards Agency (www.food.gov.uk). **Fao -** Government and voluntary policies on nutrition labelling: a global overview.

2.5.3 Nutrition Scoring

The nutrition scoring labelling style came some years later with respect to the aforementioned. As the name suggests it assigns a score to a given food according to its nutritional value. The score can be assign either using stars or a value (from 1-100) as in the USA starting from 2008, or using letters (from A to D), as in France. In the United States this method was invented by Hannafords which is a supermarket retailer. The name assigned to the scoring system was "Guiding Stars" since it assigned three stars to food with the highest nutritional value, two stars and lastly one star to food with decreasing nutritional value, but still containing some of it. In fact, the symbol is not present when food is too processed, thus unhealthy. The stars were decided on the basis of the nutrients present in the product namely: vitamins, minerals, fibres, fat, added sugar, sodium and levels of cholesterol.

The other nutritional scoring system is the NuVal system. The score is thought for all food, and not for those having at least some nutritional value. It was developed in 2008 by an autonomous research centre. The way in which it works is measuring the density of nutrients contained in a food using a 1 to 100 point scale. The closer to 100 the product scores, the higher its nutritional value. The NuVal system is by far on of the most complicated scoring system at the time, working on a complicated algorithm which evaluates the composition of 30 nutrients in each food.

A more recent nutritional scoring label which became quickly very popular but also controversial is the Nutri-score developed in France. The system pairs the use of a colour scheme (from green to red) with the use of letters (from A to E) to assign a nutritional value to food products. Looking at the score, the letter A is assigned the colour green (best nutritional quality), the letter B is assigned the colour light green, the letter C is assigned the colour yellow, the letter D the colour orange and lastly the letter E the colour red which represents worst nutritional quality. The score was invented by the EREN (*Equipe de Recherche en Epidémiologie Nutritionnelle*) in France in 2013. The score is calculated weighting healthy elements and unhealthy elements in relation to their presence inside the product. In particular, negative points are assigned to caloric level, saturated fats, sugar and sodium. On the other hand, positive points are given to fibre, proteins, vitamins from fruit and vegetables. Points are calculated per 100g/ml.

To obtain the final score positive points are subtracted from the negative one, the number obtained falls in a range of numbers which determine the final Nutri-score. A score of "A" is given to products scoring in a range of -15 to -1. The letter B is given to products scoring in the range 0 to 2. The letter C is assigned to products scoring in the range 3 to 10. The letter D to the ones scoring in the range 11 to 18 and lastly the letter E is assigned to products scoring from 19 to 40. The label is placed on the front of the pack.

Figure 2.4: From left to right: Example of United States Guiding stars, the French Nutri-score and the NuVal method. Source: Google image.

2.5.4 Calorie Labelling

Calorie labelling involves the labelling to calories on the front of the food pack, alternatively caloric labels can also be applied to menus in restaurants. As of now the use of calorie labels is still done on a voluntary basis by producers or restaurant chains and yet remains particularly unpopular, especially in Europe.

2.5.5 Health star rating

A front-of-pack nutritional label made in Australia is the "Health Star Rating". This label was developed by the Australian government in 2014. The goal of this label is to rate the overall nutritional profile of package food assigning from ½ to 5 stars as the nutritional quality increases. The stars are assigned on the basis of an algorithm which considers four main nutrients which are often associated with the greatest risk factors of the development of diseases namely: energy, saturated fats, sodium and sugar. The calculator assigns to each product a given point which lays in a range to which stars are assigned. The system's design, as shown in Figure 2.5 is an hybrid between two different styles. The first in an evaluative element composed by the starred disk, which is mostly graphical in nature.

Figure 2.5: Example of Australian HSR system. Image source: Google Image.

The second element is a reductive element composed by a PDI style panel containing the summarized nutritional information. In order for the "Health Star Rating" to be categorize as such, the presence of the disk is mandatory, while the decision to include the information panel is voluntary and it can be omitted if desired. In this last case, the FoP takes the appearance of a logo (Hamlin, 2016).

2.6 Emerged problems and solutions

It is evident that, given the voluntary adoption and the few regulations on front-of-pack labelling a plethora of different labels invaded the market. A study performed by the European commission[18] (Ipsos, 2013), identified the presence of 901 labels as of 2013. Spain and Italy were the two countries with the higher number of labelling schemes. This incredible amount of data portrayed in different forms, might create confusion in the mind of consumers (Falguera, 2012). Was after the recognition of this problem that Europe started to regulate the huge amount of labels under stringent regulations such as: EEC Regulation No. 834/2007[19] on organic food products, EEC Regulation No. 1151/2012 on developing a quality programme for agricultural products[20], as well as EEC regulation No. 1169/2011[21], on the full disclosure of food information. From this last piece of legislation the

[18] Ipsos e London Economics EAHC (2013). Consumer market Study on the functioning of voluntary food labelling schemes for consumers in the European Union EAHC/ FWC/2012 8604 .
[19] EEC No. 834/2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91. Official Journal of the European Com- munities L 189, 1e23
[20] EEC No. 1151/2012 on quality scheme for agricultural and foodstuffs. Official Journal of the European Communities L 343, 1e29
[21] EEC No. 1169/2011 on the provision of food information to consumers. Official Journal of the European Communities L 304, 18e63

placement of nutritional fact panels became mandatory in 2016 as an important way to keep consumers informed on what they are eating.

Recently a different study performed by the European FLABEL (*Food Labelling to Advance Better Education for Life*) tried to develop a comprehensive label typology which would help member states to categorize and understand all kind of nutritional labels already existing, but also hypothetical ones (Hodgkins, 2009). The typology confirms the inverse relationship between how directive the label instructs consumers about the healthiness of the food, and the amount of nutritional information presented inside the scheme. Three macro-categories have been identified by the project: Non-directive labels, semi-directive labels and Directive labels.

1. **Non-Directive Labels**: are characterized by a great amount of detailed numerical information for consumer to read and digest. They do not contain an explicit guide telling the degree of healthiness of the product nor they include benchmark levels for the nutrients. Consumers are left alone in deciding whether the product is healthy or not, relative to the type of diet are following.
2. **Semi-directive Labels**: include detailed information as non-directive labels with the difference that some form of benchmark or interpretative aid is present. This is present in the form of text or colour, in order to guide consumers in assessing the healthiness level of the product. Those labels do not explicitly tell individuals the healthiness of the product but they guide judgements giving some inputs which help consumers make more informed healthiness assessments. In particular, if a consumers sees a lot of colour red associated with the different nutrients he/she will right away associate it to an unhealthy product.
3. **Directive Labels**: these type of labels make a statement of healthiness in relation to that specific product versus competitors in the same category. These types of labels have as a goal the one to simplify to the maximum the "healthiness" assessment for the individual. No nutritional information is displayed so that the consumer has to trust the assessment already made by third parties.

Research has been trying to understand which label format was preferred by individuals. It seems that for a great part of respondents the preferred label is the one which shows the nutritional information as a percentage of the Recommended Daily Allowance (RDA) for that specific nutrient. This type of labels is part of the semi-directive family of labels described above. On a more general side, a sample of Europeans when asked to rank different labels, show heterogeneous preference for nutritional fact panel information (35% ranked NFP first), PDO (Protected Designation of Origin) information second (30% ranked it first) and the organic logo third (25% ranked the organic logo first).

From all the literature on nutritional labels it seem there exist a misalignment in the way people and policy makers perceive nutritional labels. In fact, while policy maker see nutritional label on packaged product as a variable affecting purchasing decisions; individuals tend to see themselves as indirect beneficiaries of the labels. They perceive to be affected by them because of how the label affects third parties, such as food manufacturer, which because of the label might increase its product quality. People also feel more at ease and trustworthy, participating in an industry where disclosure of information is present. This is in line with the idea that in a world which becomes increasingly frenetic individual accountable for grocery shopping want to shift the burden of accountability, quality and precision to the food industry. Food labels are a medium to make food producers of more accountable (non-use benefit), (R. J. Lenahan, 1973).

To conclude, the voluntary adoption of labels created some confusion for grocery shoppers which found attached to the product purchased a multitude of different formats of labels. During the years Europe has been trying to regulated them better, among other things by identifying some macro categories of labels but, as of now, we are still far from a unique European label to apply to all product even if this seem to be the direction Europe wants to pursue in the following years.

2.7 Nutritional labels and the importance of portion size control

The disclosure of nutritional information per recommended portion is the fundamental link between the recognized importance of controlling portion sizes and nutritional labels. The interest over the topic of portion sizes has increased in recent decades because of strong evidences suggesting its positive relationship with body weight[22]. In particular, the use of large portion size increases the energy intake of individuals; and if this surplus perpetuates overtime it could lead to the development of obesity (Young LR N. M., 2002). Literature linking portion size ad food intake dates back to 1957 with the work of Siegel (Siegel, 1957), which reveals for the first time the concept of "completion compulsion" which is the tendency of people to finish the unit of food (portion) presented to them. This effect was found particularly prominent for consumption of cookies. Later on, in 1966 the work of research carried out by Wansink (Wansink, 1996), suggested that the way food is packed affects the amount took by individuals. This was the moment in which a proper link between packaging and food selection was confirmed. On the other hand, Wansink was not able to link packaging to food intake, leaving little experimental evidence linking portion size to food intake.

[22] Dietary Guidelines Advisory Committee. Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010, to the Secretary of Agriculture and the Secretary of Health and Human Services. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC, 2010

During the years, an increase in portion sizes was recorded it the United States, which lead to individuals and family units to report consuming larger amounts of food altogether (Smiciklas-Wright H, 2003). In 2002, Nestlé and Young (Young LR N. M., 2002) revealed correlation between the increase in portion sizes, both in restaurants and supermarkets, and obesity. Looking at the psychological reasons why bigger sizes motivated overeating researchers found the concept of "consumption norms" (Fisher JO, 2003). In particular, individuals perceived the amount of food on a plate or in a given package as the "appropriate" or "ideal" amount. Thus, how food is packed or presented has an effect on expected consumption. This is the case because individuals tend to rely heavily on visual cues; in the domain of food a visual cue can be represented by a clean or empty plate, suggesting once again the importance of controlling the portion size presented. As in other circumstances, the effects of a visual cues will occur without the individual realizing it (Schwarz, 1998). To confirm this link further inferences were needed on the effect of increased portion size on energy intake. The first category of food under study were amorphous foods. For amorphous food is intended food which is pre-cooked, assembled and composed by a multitude of ingredients, which rarely are wholesome. For this type of foods it is difficult to assess a proper portion size. The experiment was performed using a perfect example of amorphous food: Mac and cheese. The result showed that recorded intake of the larger portion size offered, was greater by 30% than intake of the smallest portion presented (Rolls BJ M. E., 2002). This was consistent in two scenarios. The first one was when participants were served the plate of macaroni and cheese pre-portion by a third party. The second scenario was when participants had to serve themselves from bowls of different sizes, thus containing different portions. The majority of participates reported being unaware of the change in portion size, while at the same time experiencing same levels of fullness and satisfaction (Rolls BJ M. E., 2002).

The effect of portion size on energy intake remained consistent also for those food which have a clearly separable unit and defined shape (sandwiches), and for pre-packaged foods (chips). Respondent to the study increased their snack intake with the increase of the size of the package. Following this evidence, a branch of literature tried to investigate on whether the development of portion-controlled packaging can help moderating the consumption of energy dense foods. Results from these studies differ greatly one from another. Some outcomes show that snacks bundled in small package sizes (100 calories) can reduce consumption (Stroebele N, 2009). This effect seems particularly prominent in over-weight respondents (Wansink B, 2011). Other results suggest the creating of a backfire effect for which reducing the size of the package can lead to loosing self-control and overeat, especially for people following a low calorie eating regime (Scott ML, 2008). This contrasting results confirm the complexity of individuals' behaviour, especially concerning their food

choices. Furthermore, it seems coherent to imagine that when people find themselves in situations which are full of distraction, such as eating in restaurants or outdoors, they will show incredibly low levels of attention over portion size, and over-rely on visual cues, which in turn might cause overeating. In the domain of dining out, restaurants' portion sizes are usually bigger then recommended ones, explaining why eating out often has been correlated with over-weight tendencies (Bezerra IN, 2012).

The studies so far conducted showed the effect of portion size on energy intake over a single occasion, namely the one of the study's experiment. In order to translate these result in the day to day life of individuals, it is important to investigate on whether the effect is indeed persistent over time. Rolls (Rolls BJ R. L., 2005) showed the sustained increase in energy intake over 11 days following a daily increase in food and beverage's portion sizes of individuals participating in the experiment. At the end of the 11 days participants had registered a cumulative increase in food intake of 4636 calories. Those findings suggest that no compensatory responses exist to offset excess consumption. This confirms that larger portions (of calorie dense food in particular) have an effect, over time on the development of obesity. Leveraging this insights it seems beneficial to promote consumption of low energy dense foods, such as vegetables and fruits in order to increase fullness while controlling for energy intake. (Rolls BJ R. L., 2010).

A common message which passed over the years in order to fight obesity, or more in general maintain a healthier lifestyle, is to "eat less food" overall. Though this might be seen as unsustainable in the long run (Bell EA, 1998) and might result in cutting from the diet of vitamin rich foods with lower calorie density. Efforts should be instead translated into letting individuals understand that, the substitution of high-energy dense foods with low-energy dense ones, can result in consuming a filling and satisfying diet controlling for the portion size. Combining energy density and portion sizes greatly impacts overall energy intake (Kral TVE, 2011). Meaning that a food with a high energy density shown in a large portion size will result in the highest energy intake when compared with the other three possible scenarios deriving from the combination of energy density and portion size. This result is important for policy makers to take into account the energy density of a food when inferencing the right portion size. Overall it might not be optimal to promote reduced food consumption altogether, but rather to incentivise a proportional increase in consumption of low energy dense foods versus high energy dense ones.

In a RCT study energy density was reduced using two different strategies (Ello-Martin JA, 2007). Respondents were divided into two groups. One group was told to increase consumption of water rich foods, namely fruit and vegetable. The second group was just told to decrease overall portions.

Even if both groups were able to lose weight at the end of the study, the first group recorded a bigger reduction in energy density and an overall higher level of recorded satisfaction.

2.7.1 Portion size & weight management

Portion sizes have been increasing over time both in packaged food, in restaurants and inside people's houses (Smiciklas-Wright H, 2003). Although the link between portion size and energy intake is clear, as described in details above, fewer studies have been able to practically link potion size to body weight management, making it difficult to establish correlation between the increase in provided portions in the last years and the rise in the phenomenon of obesity. One of the most well-known effort to link portion size to weight control, is a study from the Netherlands performed in 1996 (Westerterp-Plantenga MS, 1996) which results showed that over-weight or obese woman's intake of high energy foods is higher than their intake of low energy foods comparing them to normo-weight women. In order to control portion sizes, policy makers can design actions which either target the consumer or the environment (Julia A, 2005). The first action having as a target consumers, is educating them to evaluate the proper portion to consume. This approach sadly has not recorded much positive result (Young LR N. M., 1995). Among other things, because education cannot control behaviour and, when dealing with eating behaviour in particular, a lot of irrational phenomena come into play.

Instead of educating people on which is the right amount to consume, educational efforts can be devoted to instruct people to recognized and respond to their feelings of hunger and satiety. In fact, most of the times, individuals tend not to listen to the cues sent by their body and overeat. This theory was tested on children yielding promising results (Birch LL, 1987). A more successful approach, which deals with nudging the environment is to place in commerce packaged meals of right portion sizes and caloric content (Wing RR, 2001). A practical problem has been recorded in restaurants. In the last year, particularly in fast food chains we have seen promoting discount deals when ordering larger portions of food. This goes against promoting a healthy behaviour. In fact, restaurants could promote discounts on ordering the balanced portion size instead of the over-sized one. The discount might motivate the individual to eat the right amount of food.

All the stated above might result to simplistic, since it has been found that overconsumption is strictly linked to the energy density of the food itself. So the above stated doesn't apply to all foods. A more general way to look at the problem is to focus on a reduction of energy density (while retain a good taste) instead of a reduction in portions. This was done by many products such as yogurts. Manufacturer were able to reduce the fat percentage in yogurt while keeping it palatable, thus reducing its energy density without compromising taste. Those modified product were later

distributed and sold at good prices so that individual could perceive them as a valid substitute to the full fat version.

2.7.2 Portion Size control tools

In general, people seem not able to accurately estimate their energy intake after a meal (Rolls BJ M. E., 2002). In fact, people tend to be influenced by their feeling of satiation as well as the volumetric perception of the food (Rolls BJ B. E., 2000). For this reason, policy makers started to investigate the possible tools in order to control portion sizes, as anticipated above. The most obvious one being information. In this particular circumstance information means educating individuals to identify the appropriate portion size depending on the food or beverage category. Health organizations issued a great amount of material in order for individuals to assess the correct portion. In Italy, the SINU (*Società Italiana di Nutrizione Umana*) issued the LARN code which is the acronym for "Livelli di Assunzione di Riferimento di Nutrienti ed energia". The document educates citizens on the concept of "standard portion size" and discloses the right portion for every food category and sub-category. To correctly measure the right food portion individuals are often encouraged by dieticians to use measuring tools in the prepping phase of cooking. These are tools such are measuring scales, spoons or following the American measuring systems cups. The use of such tools has shown to improve estimation accuracy (Byrd-Bredbenner C, 2004). The real question, which researches have been trying to answer, is whether or not the consistent use of such tools has an impact over time on teaching individuals how to assess portion choices. This type of on-the-spot feedback might help consumers to asses if they are eating the appropriate amount or not. As of now, there are still no certain answers on the effect of measuring tool on weight control.

A second strategy implementable to make the control of portions easier for individuals is to modify the environment in a way people are not exposed to large portion sizes as often. This can be achieved using PPFs (pre-portioned food). The use of PPFs can limit energy intake, thus promote weight control. A great variety of studies have been performed in order to investigate the effect of pre-portioned meals on weight control of individuals. Results from such studies suggest that when respondents were supplied with pre-portioned frozen meals for an extended period of time those factored in for weight loss success (Hannum SM, 2004). Foster et. Al. (Foster GD, 2013), were the first in 2013, with a study performed for 6 months, to isolate the role of portion-controlled meals from the other aspect of an individual's weight loss journey. The studies was performed over two groups, both with the intention to lose weight. One group was supplied with portion-controlled meals while the control group followed a basic dietary regime. Result confirmed that PPFs are beneficial at promoting weight loss (7.3 kilos lost by the group supplied with pre-portion foods vs. 2.3 kilos lost

by the control group over a period of 6 months). If individuals use PPFs to replace multiple meals a day their effectiveness might decrease, if people perceive a feeling of starvation due to the controlled and usually low amount of calories. Studies show a greater effect of PPFs on women than on men (Hannum SM, 2004). PPFs are also widely affected by the energy density of the food contained in the portioned meal. Reducing the energy density inside a PPFs allowed its size to be held constant while reducing its energy content (Blatt AD, 2012).

To conclude, it has been shown through multiple researches that PPFs can promote weight loss when included in a diet, but it is still uncertain if using them actually helps individual detect appropriate food portions. Looking at PPF from another perspective, we find that often when food is pre-portioned in singular serving sizes, producers decide to disclose the caloric information per-serving. Tangari, in his work of research on snacks (Tangari, 2019), suggests that the way the information is shown on the package can actually affect consumption behaviour. Snack consumption, due to the high caloric intake (if considered as a single meal over a single day), can affects weight control (Haws, 2017). Looking at disconfirmation theory (Oliver, 1977) applied to consumption of unhealthy snacks we imagine that information which is better than what we expected, can instigate what we call a "backfire effect" leading to increased consumption driven by an increase in the evaluation of the product (Grunert, 2005). In other words, if the calories per-serving on the package of an unhealthy snack, are less that what we expected them to be, there is the possibility that we increase consumption of the snack. Contrary, if the information given is worse than what the consumer expects, their perception of the product is affected by the risk of diseases and they will in turn purchase less of the product (Burton S. E., 2009). The generation of a backfire effect is not uncommon because manufacturer choose to display the smallest serving size legally authorized (Mohr, 2012), and also because people tend to pay attention to labels for unhealthy food much more than for healthy foods (Mishra, 2011) because of the risk associated with consuming unhealthy foods.

Motivational factors play a key role in this process. We can assess the motivation to pay attention to nutritional information by the amount of time spent reading the nutritional label (Moorman, 1990). From this idea, consumers with a health goal in mind will be most affected by the backfire effect. Policy makers when designing labelling policies should also take into account the possibility of such an effect appearing. A possible solution is to increase the recommended serving size, this will in turn increase the calorie per serving data. This will result more realist and show the typical amount consumed in a single time by individuals. The validity of these interventions should further be testes. Another stream of literature (Andrew B. Geier, 2006), suggests instead that individual are affected by a heuristic called *unit bias*. This applied to food consumption means that a defined food unit (within a range of functional units) is considered the appropriate amount to consume. This unit can

be determined by pre-packed products or by the amount of food people find inside their plates at a restaurant. Applying the theory of unit bias, whenever the size of the entity (portion) decreases, consumption will decrease as well. This was empirically tested comparing portion sizes in France and the United States (Rozin, 2003). Portion sizes in France's supermarket and restaurants are notoriously smaller than the ones in America, but the French seem not compensating with eating larger portions, suggesting that some kind of unit bias is in place guiding the French on the right amount to consume.

Cultural factors (Herman, 2005) come into play when we talk of unit bias since they determine a consumption norm to be applied (Wansink B. , 2004). The effect of unit bias was found to influence food selection. In particular, people had the tendency to select more food when the unit presented to them was augmented.

2.8 Food type vs food quantity

Calories have been found to be a great indicator of health goal impact (Cochran W, 1996). Considering calories as an important aspect to be taken into account when having a health goal in mind, we can identify two macro aspects which surely affect the caloric composition of a meal and thus the individual's health goal: the type of food chosen (what they eat) and the quantity of food (how much they eat) (Peggy J. Liu, 2018). Consumers can thus reduce their caloric intake either by switching to a less energy dense type of food, or to consume the same type as before, but in a smaller portion. Research suggests that those two important components are not factored-in in the same way in the mind of consumers and that, in the day to day life consumers are driven toward one of the two dimensions more. In particular, it seems that individuals are more attentive to food type rather than food quantity, which lead to a certain tendency in underweighting food quantity when performing healthiness assessment. In such a case food quantity is said to be a secondary dimension with respect to food type.

A lot of research has been done analysing the two effects separately. When we refer to a "type choice" we mean choice between a more healthy food versus a less healthy food (Dhar R, 1999). When individuals find themselves in front of this kind of choices, selecting the unhealthy type indicates an indulgent behaviour characterize by less self-control in the individual. Type choices are affected by behavioural cues. Consumers making more cognitive decisions will opt for the healthy food type while consumers making affective decisions are most likely to choose the indulgent food (Shiv B, 1999). The selection of unhealthy food also increases when consumers feel they deserve a reward (Kivetz R, 2006). When we speak of "quantity choice" on the other hand, research mostly focuses on

understanding the perception people have of portion sizes. This is of fundamental importance for policy makers to assess the appropriate portion to disclose in order to guide individuals toward healthier choices. This considering that larger portion sizes contribute to increased consumption (Rolls BJ M. E., 2002). People seem not realizing the increase in portion sizes during experiments. This is due to a great variety of reasons among which the fact that portion sizes are affected by biased estimations (Raghubir P, 1999).

When investigating the reasons for which type results a primary dimension with respect to quantity, one possible explanation resides in the order in which people process information (Hogarth, 2001). Hogarth suggest that in general, categorical attributes are processed first with respect than continuous attributes. For this reason food type, which is a categorical attribute, is processed first by default in the mind of consumers. Overall food choices involve a great amount of categorical thinking (Rozin P, 1996). Food is often assigned a category such as: healthy or unhealthy, good or bad. This type of categorization greatly affects judgment and consequently drives decision making (Peeters G, 2002). What follows from this strict categorization is the fact that quantity assessment are often shadowed and food type assessments are often used as an anchor guiding decision (Epley N, 2006). The secondary nature of quantity also persist when the quantity dimension is making salient or when the caloric information is explicitly displayed suggesting the need for a quantity assessment.

With the teachings of Hogarth in mind, it is crucial to understand if nutritional knowledge can change or affect food behaviour (Worsley, 2002). According to the statement of individual rationality, if a person knows what is better for them, they will choose it in order to behave in their greatest interests. This should then apply also to food consumption. If an individual knows which food will make their body the healthiest he/she will plan their meals accordingly. The model of individual's rationality has been abandoned back in the past, suggesting that individuals are much more complex species and this also apply to eating behaviour. But surely to a certain extent, knowledge of the composition of food will impact food consumption choices.

With knowledge we define the system of our beliefs which has the power to explain circumstances and occurrences in the world as well as increasing the predictability of events (Epstein S, 1994). Different societal groups have different systems of belief which impact their view of the world. Devoting our attention to nutritional knowledge, we can identify it as the knowledge of food composition (nutrients) and of the science of nutrition. The concept of nutrition itself is really variegated. High level of knowledge might be found is some areas of nutrition while lower levels in others. When considering the relationship between nutritional knowledge and food behaviour, motivators play a key point. Around the argument of food a great variety of motivator guide behaviour such as, social influences, biological needs, psychogenic needs and cultural values. In fact, food is

more often than not an aggregating factor, for which a lot of social dynamics come into play. Food can in fact represent the desired state an individual might want to achieve: ordering oysters may signify influence and opulence. For all this reasons, it is very difficult to map how knowledge affects behaviour. For sure nutritional knowledge has some effect, even in the context of food choice. Wardle (Wardle J, 2002), found out that high level of nutritional knowledge corresponded to higher intakes of fruit and vegetables, increasing the overall healthiness level of their diets. In this study nutritional knowledge acted as a mediator affecting food intake. This effect was confirmed inside households: the more the mother (or father) were educated about nutrition, the higher the quality of their children's diet[23]. Another study performed by Elbon (Elbon SM J. M., 1996), discovered that nutritional knowledge was positively associated with reading nutritional labels on food pack. Furthermore it was discover that knowledge affected more the quality of the product chosen more than the quantity selected (Elbon SM J. M., 2000).

2.9 Present research: defining the research question and the hypothesis

Through the pages of chapter two, so far, we went in dept analysing the abundance of literature used at the basis of the development of this present study. This sub-chapter is intended to be a bridge between the theoretical framework on which our thesis is based and chapter three, which goes in depth inside the experiment performed and its results. We started by contextualizing the theme of nutritional labels over time and across the world. Many differences emerged between nutritional labels used in different countries and the way in which they were regulated.

After going through the different types of labels and the regulatory system underneath them, we created a connection between the label and the people reading them. We wanted to make this connection clear because nutritional information, represented under the form of labels, loses its meaning and value in the moment people do not pay attention to them. In fact, nutritional labels become useless if left unread. Linking labels to people was possible thanks to the plethora of research articles on the way people interact with the labels. It emerged that some demographical differences significantly affect the reading and the understanding of the label such as gender, educational level and income level. It also emerged that, overtime the proliferation of so many different label designs created some degree of confusion in the mind of consumers and for this reason, at least in Europe, legislation is veering towards the development of a unique framework for all member states, which as of now, is yet far to be agreed upon.

[23] US Department of Agriculture Economic Research Service. Mother's nutrition knowledge is key influence on the quality of children's diets. J Am Diet Association 2000; 100: 155

After linking the labels to the people reading them, and understating their point of strengths but also their limitations, we tried to understand how the use of nutritional labels might become important when dealing with portion size control. The strong link we noticed between labels and portion sizes is the fact that is increasingly popular among manufacturer, to portray the information per portion together with the information per 100g/ml inside the label. Looking at the literature, we investigated different research done on the topic. First, we saw how portion sizes increased over time and their possible link to weight gain and the phenomenon of obesity. Then we tried to assess how inserting the information per portion might alter the perception of the food by the individual. We analysed different and also contrasting theories such as the theory of the backfire effect put forward by Tangari (Tangari, 2019) or the one of the "unit bias" made by Andrew at.al (Andrew B. Geier, 2006). We were particularly interested in understanding the effects of nutritional information framing on consumer perception because the frame of the nutritional information is the independent variable of the present study. In particular, we focused on three possible nutritional information framing namely: information per 100g of product, information per unit of the product and information per portion of that product, and how they affect the expected consumption of unhealthy snacks. We focused on unhealthy snack mainly because the majority of the effects examined by past literature were significant only for the unhealthy product category and for those product with a high energy density. Going further in dept on the topic of portion size we discovered its secondary nature with respect to the food typology (Peggy J. Liu, 2018). This added an additional level of complexity because it suggested us that people can make rightful judgements when evaluating food type but that they get lost when evaluating portions, which come always secondary to type when making healthy eating assessments.

This opened a new topic for discussion, analysed in the previous pages, which is how policy makers can educate people to the right portion sizes. Among the possible interventions there is the one of supplying to people pre-packaged portions based on the appropriate amount to consume of that product. This aspect of the literature was of fundamental importance in light of the present study because it is the moderator of our analysis. We choose two possible package formats which are a loose package of biscuit and a pre-packed pack with three biscuits per pack. We used a moderating model because we wanted to understand how the format of the pack affected the relationship between the framing of the nutritional information inside the label and the consumption intention for the unhealthy snack category. We define our research question as: how the framing of the nutritional information (100g/unit/portion) affects the consumption intention of unhealthy snacks when moderated by the packaging of the product (loose vs. prepack).

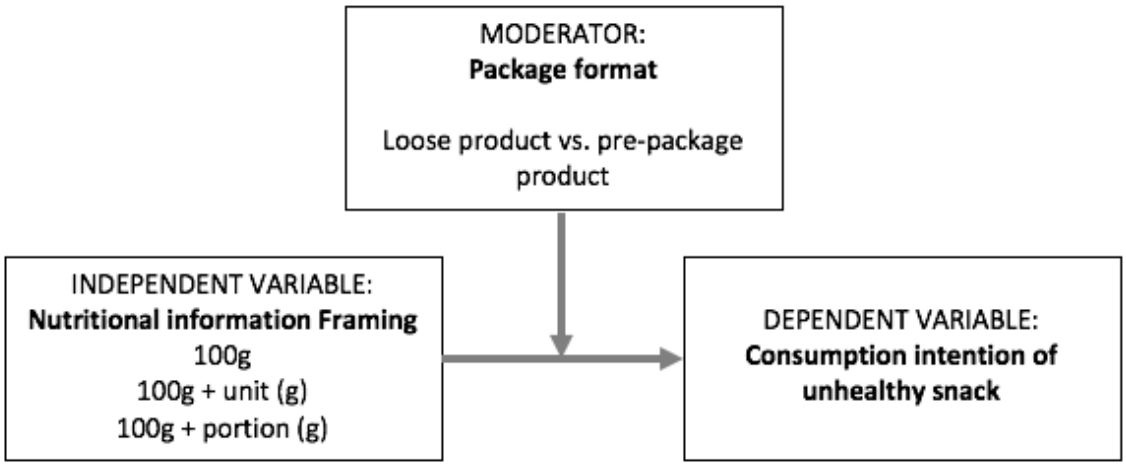


Figure 2.6: Experimental model. Source: Own elaboration.

In order to answer the research question, which is modelled in the figure above, I developed two hypothesis. The first hypothesis is designed on the relationship between the independent variable and the dependent variable. In particular, I wanted to compare possible emerging differences arising from showing the nutritional information per unit versus showing the nutritional information per portion of the product. In order to do so, I created the hypothesis based on the literature investigated in details in the preview pages, devoting particular attention to the work of Tangari (Tangari, 2019) which suggests the possible creation of a backfire effect when nutritional information is decomposed in smaller units with respect to when it is showed per 100g, relying on the theory of disconfirmation proposed by Oliver (Oliver, 1977). With the aim of testing for the presence of a possible backfire effect on consumption when compare unit and portion we hypothesize that:

> **H1:** Provide calorie information of unhealthy snack per 100g paired with unit(g), rather than per 100g paired with portion(g), increases the individual's consumption intention for the unhealthy snack category.

The second hypothesis is based on the relationship between the dependent and the independent variable when moderated by a loose versus a pre-pack packaging. This second hypothesis was developed based on the literature described in details throughout chapter two, especially focusing on the work of Wing (Wing RR, 2001) suggesting the positive nudge of using pre-package portion sizes, to control consumption. We hypothesize that:

H2: The proposed packaging (loose vs. pre-packed) moderates the relationship between the framing of the calorie information and consumption intention. In particular, the effect of the 100g information paired with the unit information in strengthened in case of a loose pack, while it is weakened in case of a pre-packaged snack.

According to H2 the use of pre-packed portion as a moderator has the power to control the effect suggested by H1.

With the definition of the research question and the design of the hypothesis we conclude the second chapter of this dissertation. The next page will open chapter three, which will start with explaining the methodology of the experiment, followed by the analysis of the results and their implications: both theoretical and managerial. The chapter will end with explaining possible limitation of the study and gaps to be analysed in future dissertations or work of research.

Chapter 3

3.1 Methodology and Survey preparation

In order to answer the research question defined at the end of the second chapter of this dissertation, I started to design a possible experiment to test the two hypothesis. Because of the closure of all university imposed by the Covid-19 pandemic, me and my Advisor had to drop the initial idea of performing an on field experiment inside the university's cafeteria. We then decided to replace the experiment using an online survey to collect our data. The advantage of using an online survey was surely reaching a higher a more variegated pool of people, so that not all respondents would have been university students. I hoped, in this way, to work with a sample which is best representative of the population, with respect to the visitors of a university cafeteria. A drawback for this specific type of experiment is that respondents are forced to imaging themselves performing the action exemplified in the questionnaire instead of truly living it on field. The survey was generated using a programme called Qualtrics and then distributed via an anonymous link. Given the circumstances, the sampling method used is a virtual snowball sampling method, which fall in the category of the non-probabilistic sampling techniques. This sampling technique involves subjects which completed the survey, to recruit more respondents among their pool of influence and so on, in a chain manner. The goal is to have this chain or snowball of respondents large enough to ensure that the data collected are meaningful and biases are reduced to a minimum. The disadvantages of using a non-probabilistic sampling technique with respect to a probabilistic way of sampling will be analysed and considered in the following pages when dealing with the possible limitations of the study. In order to design the questionnaire the first step was to design the stimuli the respondents would see, in my case the two packages of biscuits: one loose and one already portioned. The second step was to pair the stimulus to the circumstance the respondent is asked to imagine. The description of the circumstance has to be vivid and clear enough to help the individual to visualize the action he/she is asked to undertake. Lastly, in order to write the survey's questions literature is reviewed to collect the validated scales of reference. These steps will be discussed in more details in the following two sub-chapters.

3.1.1 Generating the scenarios

I started developing the scenarios by researching the top brands of biscuits sold in Italian supermarkets; looking in particular at the those which, for their nutritional composition, would fall in the unhealthy category, which is the one under scrutiny in this dissertation. The goal of the search was to find a product to adapt as the stimulus the respondent of the questionnaire would see. To choose the perfect product, I mostly focused on their nutritional labels because the label itself would

appear as part of the questionnaire next to the stimulus. After proper scrutiny, I choose the "*Baiocchi*" biscuits by the Italian brand "Mulino Bianco" as my prototype. The choice was driven by two main points: firstly "*Baiocchi*" resulted one of the worst biscuits in commerce when looking at their caloric content, thus representing a great approximation for the unhealthy biscuit category; secondly the product is sold in a variety of different formats which become crucial for the analysis of the moderator. The four different sizes sold are: a loose pack with a weight of 260g, a loose tube weighting 168g and two pre-sized formats, one containing 6 biscuits per pack and the other containing 3 biscuits per pack. For the sake of this research, I chose two out of the four packaging: the 260g loose pack and the pre-sized pack containing 3 biscuits.

Biscuit type (unhealthy category)	Calories (100g)	Grams per unit	Calories per unit	Calories per portion
Nutella Biscuit Ferrero	513 Kcal	13,8g	71 Kcal	154 Kcal
Baiocchi Mulino bianco	511 Kcal	9,3g	47 Kcal	141 Kcal
Milka Cookies sensations	510 Kcal	26g	133 Kcal	133 kcal
Bisco Crema Barilla	497 Kcal	28g	139 Kcal	139 Kcal
Pan di stelle Barilla	483 Kcal	7,8g	38 Kcal	146 Kcal
Gocciole Classiche Pavesi	481 Kcal	12g	59 Kcal	148Kcal
Oreo	470 Kcal	11g	52 Kcal	142Kcal

Table 3.1: Summary table of the most sold biscuit brands in Italy for the unhealthy category. Source: Own elaboration.

The nutritional table which Mulino Bianco displays on the back of the pack of Baiocchi contains the information per 100g and per biscuit (unit of product). In particular, each biscuit weights 9,3 grams for a total of 47 Kcal. The calories per 100g are 511, more than the mean of the biscuits on the market, but overall around the mean for the biscuits in the unhealthy category. The brand does not provide the information per serving which we need in order to develop all the scenarios. Furthermore, in Italy the definition of portion in arbitrarily decided by each brand so that a consistent definition cannot be found. For this reason, I decided to adopt the portion size guidelines drafted by the SINU (*Società Italiana di Nutrizione Umana*)[24] which defines a portion of biscuits as equal to 30g of product, which corresponds to around 3 biscuits for the unhealthy category.

After collecting all the relevant information, I developed a 3x2 matrix in which each column corresponds to a different framing of the nutritional information as a combination of the 100g information, the information per unit and the information per portion, while the rows display the two formats of packaging chosen which are the loose 260g pack and the pre-pack box containing 6 portions each made of three biscuits.

[24] https://sinu.it/wp-content/uploads/2019/07/20141111_LARN_Porzioni.pdf)

	100g	100g + one biscuit (g)	100g + one portion (30g)
LOOSE PACK (260g)	100g contain 511 Kcal	100g contain 511 Kcal. + One biscuit (9,3g) contains 47 Kcal.	100g contain 511 Kcal. + One portion (30g) contains 141 Kcal
PRE-PACKED (3 biscuits)	100g contain 511 Kcal	100g contain 511 Kcal. + One biscuit (9,3g) contains 47Kcal	100g contain 511 Kcal. + One portion (30g) contains 141 Kcal

Table 3.2: 3x2 matrix of the model's design. Source Own elaboration.

After re-designing the nutritional tables on Excel, I created the stimuli on Power Point. Starting from the two pictures of the package of "*Baiocchi*" by Mulino Bianco I then removed all the information concerning the brand as well as the picture of the iconic biscuit. "*Baiocchi*" have close to 100% brand awareness in Italy, they represent a very popular snack for children and both the product and the pack are indeed iconic. When preparing the graphic I tried to transform the pack in a neutral biscuit pack to exclude feelings such as loyalty to the brand or emotional attachment to the product. I also slightly changed the tone of the colour to avoid remembrance to the yellow Pantone used by Mulino Bianco for its package snack product. The two stimuli are shown in figure 3.1.

Figure 3.1: Prototype of the two stimuli designed for the experiment, taken from a pack of "Baiocchi" by Mulino Bianco. Source: Own Elaboration.

After all the stimuli were prepared, the image of the new packet of biscuits and the new nutritional tables were put together to prepare the six different scenarios summarized in table 3.2. The questionnaire was designed and written in Italian because the population of respondents is Italian of nationality. The page in which the participants were shown the stimuli contained a message which text depended on the randomized package they saw. Two different stories were written for this purpose. One message was created for the 260g loose pack and a similar one for the 3 biscuits pre-packed. When writing the two scenarios I tried to activate the senses of the respondent reading the questionnaire, and to make the situation as close to one already experienced in the life of the person. In thinking about the specifications, I made sure no possible doubt could arise, specifying that the pack of biscuit was new and closed and that respondents could eat as many as they felt like. I then also specified that the nutritional information were reported that big just for the sake of easing the reading process, so to not disclose too evidently what the experiment is about.

The first message, created for the loose package, was the following:

> "*Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa un pacco di biscotti sfusi per il tuo snack. Il sacchetto è il seguente ed è ancora chiuso. Sul retro del pacco sono riportate le informazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dal pacco puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande".*

The second message, created for the pre-packed stimulus, was the following:

> "*Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa una confezione di biscotti già porzionati per il tuo snack. La confezione contiene 6 porzioni da tre biscotti l'una. Il pacco è il seguente e sul retro sono riportate le indicazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dalla confezione puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande*".

The pair of the each visual stimulus with the text gave birth to six possible scenario. Each person responding to the questionnaire will see only one scenario, as a result of a process of randomization applied on Qualtrics. After the visual and the verbal cue, the person will be asked to answer a variety of questions linked to the variables of the study. The finalized scenarios are the following:

Scenario A.1: Loose pack with information per 100g

Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa un pacco di biscotti sfusi per il tuo snack. Il sacchetto è il seguente ed è ancora chiuso. Sul retro del pacco sono riportate le informazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dal pacco puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande.

Valori medi	per 100g
ENERGIA	511 Kcal
GRASSI: di cui: acidi grassi saturi	26g 7,5g
CARBOIDRATI: di cui zuccheri	60g 21,5g
FIBRE	3,3g
PROTEINE	7,5g
SALE	0,750g

Scenario A.2: pre-pack with information per 100g

Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa una confezione di biscotti già porzionati per il tuo snack. La confezione contiene 6 porzioni da tre biscotti l'una. Il pacco è il seguente e sul retro sono riportate le indicazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dalla confezione puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande.

Valori medi	per 100g
ENERGIA	511 Kcal
GRASSI: di cui: acidi grassi saturi	26g 7,5g
CARBOIDRATI: di cui zuccheri	60g 21,5g
FIBRE	3,3g
PROTEINE	7,5g
SALE	0,750g

Scenario B.1: Loose pack with information per 100g + per unit (9,3g)

Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa un pacco di biscotti sfusi per il tuo snack. Il sacchetto è il seguente ed è ancora chiuso. Sul retro del pacco sono riportate le informazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dal pacco puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande.

Valori medi	per 100g	per biscotto (9,3g)
ENERGIA	511 Kcal	47 Kcal
GRASSI: di cui: acidi grassi saturi	26g 7,5g	2,4g 1,0g
CARBOIDRATI: di cui zuccheri	60g 21,5g	5,6g 2,0g
FIBRE	3,3g	0,3g
PROTEINE	7,5g	0,7g
SALE	0,750g	0,070g

Scenario B.2: pre-pack with information per 100g + per unit (9,3g)

Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa una confezione di biscotti già porzionati per il tuo snack. La confezione contiene 6 porzioni da tre biscotti l'una. Il pacco è il seguente e sul retro sono riportate le indicazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dalla confezione puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande.

Valori medi	per 100g	per biscotto (9,3g)
ENERGIA	511 Kcal	47 Kcal
GRASSI: di cui: acidi grassi saturi	26g 7,5g	2,4g 1,0g
CARBOIDRATI: di cui zuccheri	60g 21,5g	5,6g 2,0g
FIBRE	3,3g	0,3g
PROTEINE	7,5g	0,7g
SALE	0,750g	0,070g

Scenario C.1: Loose pack with information per 100g + per portion (30 g)

Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa un pacco di biscotti sfusi per il tuo snack. Il sacchetto è il seguente ed è ancora chiuso. Sul retro del pacco sono riportate le informazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dal pacco puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande.

Valori medi	per 100g	per porzione (30g)
ENERGIA	511 Kcal	141 Kcal
GRASSI: di cui: acidi grassi saturi	26g 7,5g	7,2g 3,0g
CARBOIDRATI: di cui zuccheri	60g 21,5g	16,8g 6,0g
FIBRE	3,3g	0,9g
PROTEINE	7,5g	2,1g
SALE	0,750g	0,21g

Scenario C.2: pre-pack with information per 100g + per portion (30g)

Immagina di avere un certo languore e ti accorgi che è ora di uno spuntino. Riesci a reperire in dispensa una confezione di biscotti già porzionati per il tuo snack. La confezione contiene 6 porzioni da tre biscotti l'una. Il pacco è il seguente e sul retro sono riportate le indicazioni nutrizionali del prodotto, ingrandite qui sotto per comodità. Dalla confezione puoi prendere quanti biscotti vuoi. Osserva attentamente l'immagine e le informazioni nutrizionali fornite e rispondi alle seguenti domande.

Valori medi	per 100g	per porzione (30g)
ENERGIA	511 Kcal	141 Kcal
GRASSI: di cui: acidi grassi saturi	26g 7,5g	7,2g 3,0g
CARBOIDRATI: di cui zuccheri	60g 21,5g	16,8g 6,0g
FIBRE	3,3g	0,9g
PROTEINE	7,5g	2,1g
SALE	0,750g	0,21g

3.1.2 Scales and measures

The next step, after creating the scenarios, was to find the appropriate scales to measure the variables of the study, as well as some other variable which will work as control variables. In order to do so, I performed a wholesome review of the literature to find pre-validated scales used by other authors in past studies. In order to investigate on the dependent variable: consumption intention, two different scales have been employed. A scale measure developed properly for consumption intention and a scale measuring propensity to consume which is used as a proxy measure. The chosen scales are reported in more details, and for the sake of simplicity, in the following table.

Measure	Author	Statement & Items
Consumption intention	*(adapted from)* De Bruijn et al., 2015	**3 – item, open answer** I plan to consume… I intend to consume… It is very likely I will eat…
Propensity to consume	*(adapted from)* Hsu et. Al., 2016	**3- item, 7-points scale** I intend to consume… I would consume… I am inclined to consume…
Perceived healthiness	Ares et al., 2008	**1-item, 7-points scale** (1 = not healthy at all; 7 = very healthy). How healthy do you think this product is?
Frequency of consumption	Richards et. Al., 2015	**1-item, 7-points scale** (1= Never; 7= everyday). "How often did you eat this product"
Health concern	*(adapted from)* Kähkönen et al., 1995	**4-item, 7 points scale** (1 = not concerned at all; 7 = very concerned). How concerned are you about the following issues? Getting many calories; Risk for high blood pressure; Risk for coronary heart disease Gaining weight

Interest in nutrition information	*(adapted from)* Moorman, 1990	**2-item, 7-points scale** (1= strongly disagree; 7 = strongly agree). To what extent do you agree with the following statements? I am interested in looking for (target nutrient) information on (product) label I intend to pay attention to (target nutrient) information on (product) labels.
Frequency of caloric information reading	Tangari et al., 2019	**1-item, 7-points scale** (1 = none of the time; 7 = all of the times). How often do you pay attention to caloric information?
Likeability	*(adapted from)* Peryam & Pilgrim, 1952	**1-item, 7-points scale** (1 = extremely dislike; 7 = extremely like). Overall, how much do you like or dislike this product?
Hunger assessment	*(adapted from)* Tangari et al., 2019	**1-item, 7-points scale** (1 = not at all hungry: 7 = very hungry). How hungry are you at the moment?

Table 3.3: validated scales used for the questionnaire, with authors and measures.

3.2 Participants and Data cleaning

As introduce in the previous pages, data were collected via an online survey designed using the software Qualtrics. The survey was prepared using the scale collected in Table 3.3 and sent to participants using an anonymous link which they could later use to send it to their list of contacts. The questionnaire was kept online for one week before data extraction. The total number of respondents were 503 people among male and female. Not all respondents were used for the analysis because all data were screened and cleaned prior to inspection on SPSS. First, I checked the V10 column on SPSS to see if some questionnaires were left uncompleted; fortunately no data was removed for this reason since all surveys were fully completed.

Later on, I looked over the responses given to the "attention check" present in the survey. The question stated to select "*strongly agree*" on a seven points Likert scale to assess the level of attention

kept throughout the survey. Thirteen people failed to answer the attention check and were removed from the analysis. The process of data cleaning continued by checking for response time and biased answers. In particular responses were screened to see if some person answered the same scale value on all questions as well as the time needed to complete the survey. Qualtrics estimated seven minutes as average response time needed to complete the survey so all responses recording more than 20 minutes were removed. During this process a total of 35 responses were deleted, defining the final sample of 455 participants.

After the sample was cleaned I could check the demographics, in particular age and gender were investigated in the questionnaire. Starting from gender, among the 455 respondents 156 (34,3%) were male while 299 (65,7%) where female. The presence of a higher number of women in the sample could affect the results, this difference will be later on investigated in the analysis.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Maschio	156	34,3	34,3	34,3
	Femmina	299	65,7	65,7	100,0
	Total	455	100,0	100,0	

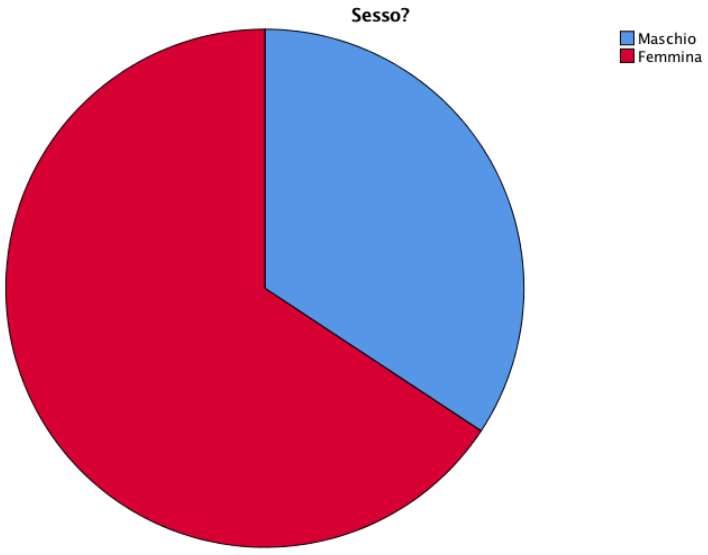
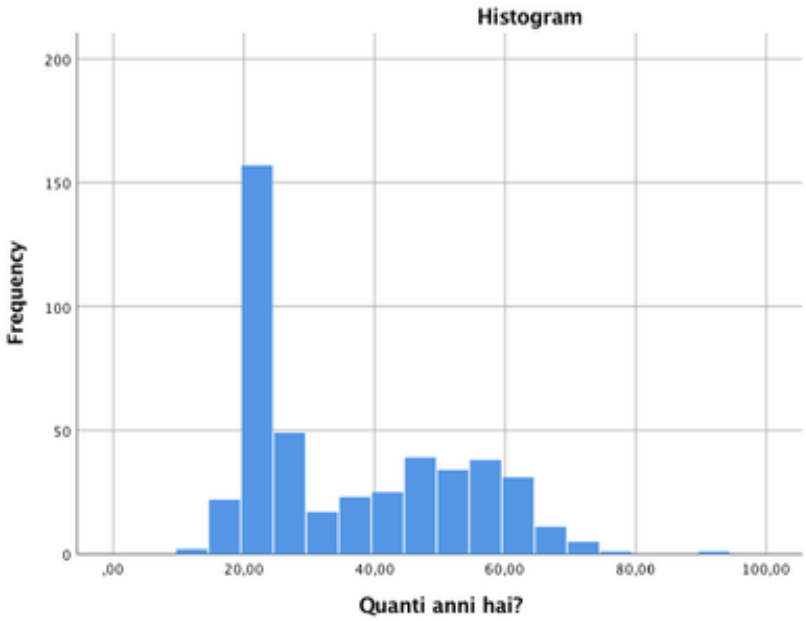


Figure 3.1: Gender demographics. Source: Own elaboration from SPSS.

Looking at data on age, the sample of respondents resulted very mixed. The minimum age was 12 years old while the maximum age was 91 years old. Overall, mean age was 36,5 year old while median age was 29 years old. Looking at the mode, which is 23 years old, a peculiarity appears in the data. In fat, 68 respondents which correspond to 14% of the sample, are 23 years old. This characteristic

of the sample, very visible in the frequency histogram below, will also be commented later on in the analysis.



Statistics

Quanti anni hai?

N	Valid	455
	Missing	0
Mean		36,5538
Median		29,0000
Mode		23,00
Std. Deviation		15,96571
Minimum		12,00
Maximum		91,00

Figure 3.2: Age demographics. Source: own elaboration from SPSS.

Among the 156 male respondents mean age is 34 years old and median age is 26 years old. On the other hand, among the female sub-sample mean age was 37 years old while median age was 33 years old. Overall, female respondents were older than male respondents.

Statistics (a)

Quanti anni hai?

N	Valid	156
	Missing	0
Mean		34,0833
Median		26,0000
Mode		23,00
Std. Deviation		14,18812
Minimum		12,00
Maximum		77,00

Statistics (b)

Quanti anni hai?

N	Valid	299
	Missing	0
Mean		37,8428
Median		33,0000
Mode		23,00
Std. Deviation		16,69662
Minimum		12,00
Maximum		91,00

Figure 3.3: Age demographics by gender: (a) male (b) female. Source: own elaboration from SPSS.

After looking at the general demographics of the total sample, I thought to also consider the demographics for each single scenario. Each respondent was randomized to one and only scenario so

investigating more in details on demographic differences inside each scenario, could bring meaningful hints later on for the analysis. Results are summarized in the following table.

		Gender		Age	
Scenario assigned	**Number per scenario**	**male**	**female**	**mean**	**median**
Scenario A.1: **Loose pack + 100g**	77 people	23	54	38,6 y.o.	34 y.o.
Scenario A.2: **Pre-packed + 100g**	80 people	33	47	35,26 y.o.	27 y.o.
Scenario B.1: **Loose pack + (100g + unit)**	74 people	23	51	35,7 y.o.	31,5 y.o.
Scenario B.2: **Pre-pack + (100g + unit)**	80 people	30	50	34,6 y.o.	26 y.o.
Scenario C.1: **Loose pack + (100g + portion)**	76 people	29	47	38,3 y.o.	37 y.o.
Scenario C.2: **Pre-pack + (100g + portion)**	68 people	18	50	36,0 y.o.	30,5 y.o.

Table 3.4: Demographics per scenario. Source: own elaboration.

Overall, between 68 and 80 people saw each scenario. Probably before the data cleaning process the number of people per scenario was even more balanced, but overall the division results pretty equilibrated. In all six scenario female were more than men. The number of male respondents in the scenario C.2 is particularly low. This feature must be noted for future analysis.

Once again the median age of the overall sample is pretty young and equal to 29 years old. Looking at the median age for each scenario, respondents which saw scenario C.1 were older compared to the others. In fact, the median age of the C.1 scenario is 37 years old which is 8 years older than the median age of the overall sample. Contrary to that, people which saw scenario A.2 and B.2 were younger than the median age of the overall sample having respectively a median age of 27 years old and 26 years old. It is good practice to remember and if needed take into account these age differences. After understanding in details the sample of respondents I'm ready to start the analysis using the statistical software SPSS.

3.3 Analysis and results

After the data cleaning was performed, the data set was ready to be analysed. The analysis carried out is a two-way ANOVA. But, before computing it some manipulations of the variables were necessary. Firstly, I needed to check the reliability of the multi-items scales. This was measured looking at the Cronbach Alpha coefficient. In particular I had three multi-items scales inside my questionnaire: a "consumption propensity" scale composed by three items, a "nutrition interest" scale made by two items, and a three items "health concern" scale. Luckily all three scales were internally consistent satisfying the minimum level of 0.7 and not going above 0.95. In particular, the Cronbach alpha for the "propensity to consume" scale is equal to 0,932, the one for the "nutrition interest" scale is 0,949 and the one for the "health concern" scale is equal to 0,794. Evidences from the reliability test are inserted in figure 3.4.

Reliability Statistics

Cronbach's Alpha	N of Items
,932	3

Cronbach's Alpha	N of Items
,949	2

Cronbach's Alpha	N of Items
,794	4

Figure 3.4: Cronbach Alpha coefficient of multi-items scales. Source: own elaboration from SPSS

After ensuring the reliability of all three multi-items scales I could compute the three new variables coded as "nutrition interest", "consumption" and "health". Among those, consumption is the dependent variable of analysis.

The next preparatory step before computing the two-way ANOVA is to recode respectively the independent variable "nutritional information framing" and the moderating variable "packaging". The first became the variable "frame" taking values of 0 when the information was presented per 100g, 1 when the information was presented per 100g + per portion (30g) and 2 when the information was presented per 100g + per unit (9g). The second variable was recoded as a dummy variable "pack" taking values 0 when the pack saw was loose and 1 when the pack was pre-portioned.

After completing the preparatory steps, I run the two-way ANOVA using the univariate model from SPSS. Once again, the model was constructed with consumption as the dependent variable, frame having three levels as the independent variable and lastly pack as the moderator of the analysis, coded as a dummy variable 0-1. The goal of the analysis was to investigate on both the main effect of the independent variable on the dependent variable, namely if the way in which nutritional information is framed affects consumption intention; but also if the pack moderates this relationship and if so in which direction. The outcome of the analysis is shown in figure 3.5 and figure 3.6 below.

Tests of Between-Subjects Effects

Dependent Variable: Consumption

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	29,484[a]	5	5,897	2,044	,071	,022	10,218	,682
Intercept	7052,270	1	7052,270	2444,115	,000	,845	2444,115	1,000
Frame	17,853	2	8,926	3,094	,046	,014	6,187	,595
Pack	6,138	1	6,138	2,127	,145	,005	2,127	,307
Frame * Pack	5,152	2	2,576	,893	,410	,004	1,786	,204
Error	1295,548	449	2,885					
Total	8411,667	455						
Corrected Total	1325,032	454						

Figure 3.5: two-way ANOVA test of between-subjects effects. Source: own elaboration from SPSS

Descriptive Statistics

Dependent Variable: Consumption

Frame	Pack	Mean	Std. Deviation	N
,00	,00	3,5195	1,70782	77
	1,00	4,0500	1,73659	80
	Total	3,7898	1,73751	157
1,00	,00	3,7939	1,70834	76
	1,00	3,8529	1,43907	68
	Total	3,8218	1,58171	144
2,00	,00	4,1667	1,83011	74
	1,00	4,2750	1,71923	80
	Total	4,2229	1,76838	154
Total	,00	3,8223	1,76111	227
	1,00	4,0702	1,64879	228
	Total	3,9465	1,70838	455

Figure 3.6: two-way ANOVA descriptive statistics matrix. Source: own elaboration from SPSS

Looking at the interaction effect first, unfortunately the p-value of the interaction between frame and pack in greater than 0.05 thus not significant, in other words the effect of nutritional information frame on consumption doesn't differ or change depending on how the product is packed. Similarly, the effect of pack on consumption is not statistically significant (p-value = 0.145), making me incapable of inferring the effect of pack on consumption on its own.

Interestingly, I shift the attention on the main effect of frame on consumption. The p-value is smaller than 0.05 suggesting a significant effect of nutritional information framing on consumption intention. In other world the way in which the information is framed affects consumption. To deepened the understanding of this effect the descriptive table can be look at. We can see that consumption increases moving from zero to two. In particular, mean consumption is equal to 3,7 biscuits when the information is presented per 100g solely, 3,8 biscuits when the information is presented per 100g and

per recommended portion and 4 biscuits when the information is presented per 100g and per unit. This findings confirm the first hypothesis presented in this dissertation suggesting an increase in consumption of unhealthy food product as the absolute level of calorie information decreasing, as the result of a possible backfire effect of consumption driven from licensing behaviours.

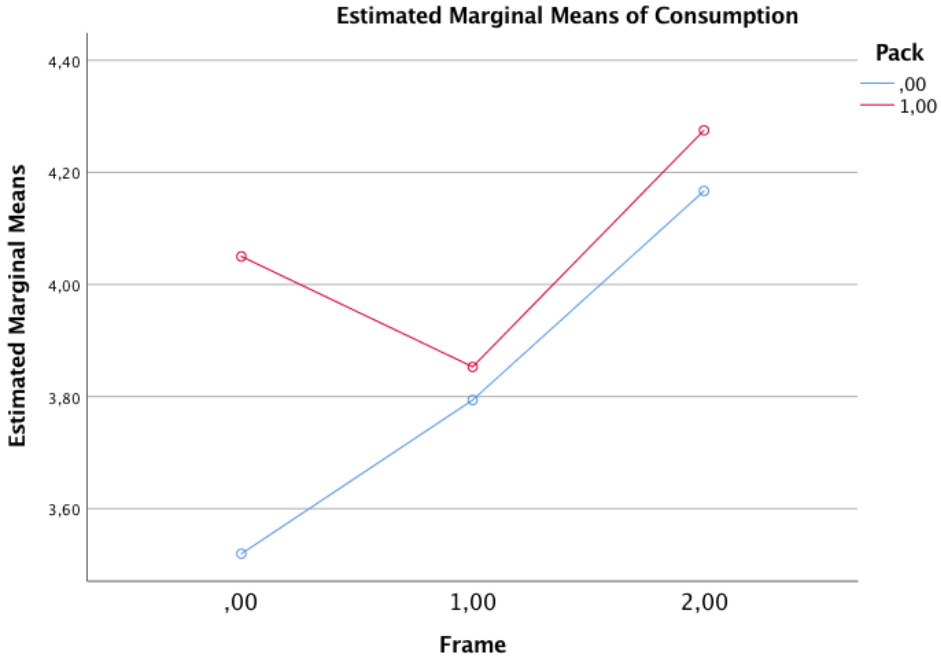


Figure 3.7: two-way ANOVA profile plot. Source: own elaboration from SPSS

The significance of the main effect is also visible by the plot above which lines are very steep and differentiated one from the other, suggesting the effect of frame on consumption.

Going more in depth on the significance of the main effect, I investigated it according to age, suspecting differences among age group. I decide to take as the reference age to split the sample the median age of 29 years old. And I re-run the analysis with the selected data. The results of the two-way ANOVA are reported below in figure 3.8, 3.9 and plotted in figure 3.10.

Tests of Between-Subjects Effects

Dependent Variable: Consumption

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	21,903[a]	5	4,381	1,738	,127	,037	8,688	,593
Intercept	4197,107	1	4197,107	1664,718	,000	,881	1664,718	1,000
Frame	19,907	2	9,953	3,948	,021	,034	7,896	,705
Pack	,226	1	,226	,090	,765	,000	,090	,060
Frame * Pack	1,885	2	,942	,374	,689	,003	,748	,110
Error	564,752	224	2,521					
Total	4842,222	230						
Corrected Total	586,655	229						

Figure 3.8: two-way ANOVA test between-subjects effect (age <= 29). Source: own elaboration from SPSS.

Descriptive Statistics

Dependent Variable: Consumption

Frame	Pack	Mean	Std. Deviation	N
,00	,00	3,7838	1,68365	37
	1,00	4,0606	1,78462	44
	Total	3,9342	1,73399	81
1,00	,00	4,4381	1,35707	35
	1,00	4,2647	1,18287	34
	Total	4,3527	1,26786	69
2,00	,00	4,5810	1,75705	35
	1,00	4,6667	1,59545	45
	Total	4,6292	1,65778	80
Total	,00	4,2586	1,63319	107
	1,00	4,3388	1,57738	123
	Total	4,3014	1,60057	230

Figure 3.9: two-way ANOVA descriptive statistics matrix for age <= 29. Source: own elaboration from SPSS.

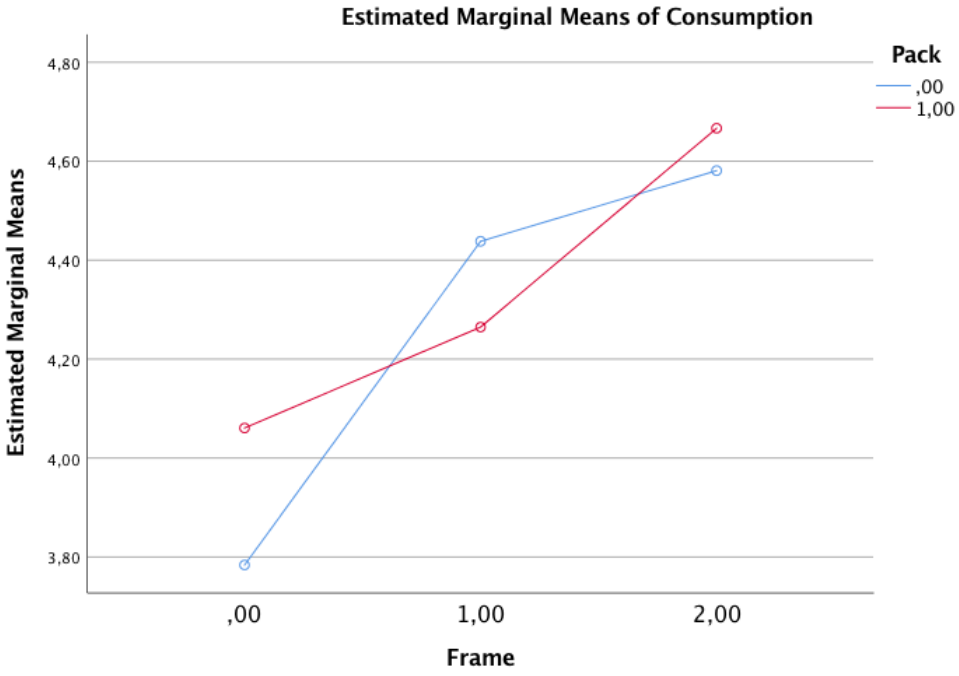


Figure 3.10: two-way ANOVA profile plot, for age <= 29. Source: own elaboration from SPSS

Among the 455 participants, 230 of them were below 29 years old or were exactly 29. While the interaction effect remains not statistically significant, the significance on the main effect of frame improves for the youngest sub-sample. In fact, the p-value is below 0.05 (= 0,021), suggesting that, for this age group, the way in which the nutritional information is framed affects consumption intention significantly. More in details, consumption increases from 0 (100g) to 2 (100g + unit) satisfying our first hypothesis. Mean consumption is equal to 3,9 biscuits when the information is presented per 100g solely, 4,3 biscuits when the information is presented per 100g and per

recommended portion and 4,6 biscuits when the information is presented per 100g and per unit. Overall, comparing mean among the two age groups suggests that young individuals consume more biscuits than the older sub-sample for all three scenarios, which paired which the improvement in significance level might signify the poorer ability of the younger generation to self-control themselves when choosing the amount to consume of unhealthy snacks.

3.4 Discussion

In order to discuss in depth the results, I want first to check the mean levels of the control variables inserted in the questionnaire, to see the preferences of the respondents regarding topics which potentially might impact food consumption behaviour. Once again, the stimuli used for this dissertation were biscuits, so I wanted to have an idea of how biscuits were perceived by the sample. On a 7-points Likert scale, biscuits scored pretty high in likeability. In fact, the mean score for the likeably variable, measuring how much people liked biscuits, is 4,74. In line with people preferences, respondents declared to consume biscuits from 2 to 3 times a week, which corresponds to the fifth point on a 7-points Likert scale. A high level of preference for biscuits as well as a high frequency of consumption were auspicial, suggesting familiarity with the product which in this case probably helped respondents visualize the scenario presented in the survey.

A measure for the perceived healthiness of the product was inserted to see if respondents would assign biscuits to the unhealthy snack category. Luckily, when asked how healthy on a 7-points Likert scale they perceive the product to be, the mean recorded value was 2,62 which suggest that rightly people perceive biscuits to be an unhealthy snack.

Both nutrition interest, measured asking individuals how often do they devote attention to calories and calorie information; and the concern of health, measured asking respondents how preoccupied are they of gaining weight, developing high blood pressure and cardiovascular diseases, scored mean values lying in the middle of the scale. In particular, health concern scored 4,4 and nutrition interest scored 4,5, suggesting that the respondents were not very polarized regarding health and nutrition, but showed only a slight interest in those topics.

Lastly, as mentioned by Tangari et. Al. (Tangari, 2019), I also wanted to investigate hunger at the time of completion of the questionnaire. This because, when measuring food consumption, the level of hunger will probably affect quantity consumed, in particular of unhealthy snacks. The mean level of hunger for this sample was 2,71. I am happy with a lower level of hunger assessment because it means that people did not overestimate their answers due to hunger. Such a low level let me hope that a more rational decision-making process has been used while answering the survey.

Statistics

		Quanto ti piacciono i biscotti?	Con che frequenza consumi biscotti?	Quanto salutare consideri il prodotto che hai visto?	Stai seguendo una dieta particolare al momento?	Quanto sei affamato al momento?	Health	Nutritioninterest
N	Valid	455	455	455	455	455	455	455
	Missing	0	0	0	0	0	0	0
Mean		4,74	4,47	2,62	1,77	2,71	4,4456	4,5033
Median		5,00	5,00	3,00	2,00	2,00	4,5000	4,5000
Std. Deviation		1,712	1,762	1,209	,422	1,591	1,51432	2,02666
Minimum		1	1	1	1	1	1,00	1,00
Maximum		7	7	7	2	7	7,00	7,00

Figure 3.11: frequency table for control variables. Source: own elaboration from SPSS

Now, I can discuss the results in light of the mean levels of the control variables. Unfortunately, nothing can be said about the interaction effect of frame and pack which is not statistically significant from our analysis. The manipulation of the pack resulted very tricky to perform using an online survey method, and possibly results will be much different if the same experiment, manipulating the biscuits' packaging, is done on field.

On the other hand, the main effect of frame on consumption resulted statistically significant, satisfying fully the first hypothesis of this dissertation. This finding is of great importance for multiple reasons. Firstly, it confirms the theory of Tangari et. Al. (Tangari, 2019), suggesting the creation of a backfire effect when calorie information on unhealthy snack are presented in smaller units, giving the impression of assimilating a lower calories intake. Secondly, it deepens the findings of Tangari. This because Tangari experiment compares calorie information per 100g with calorie information per recommended portion of the snack. This thesis goes a step beyond designing a 3 levels frame comparing both the 100g information, with the information per portion and the information per unit, which shows a still smaller calorie level compared to the portion. In all the three cases calories are shown in grams enabling a better comparison and consistency among the three frames. As we expected from Tangari studies individual consumed more when the information was given per portion with respect to when the information was give per 100g. Then we discovered that individual consumed even more when the information was given per unit with respect to when it was given per portion. This findings, shed light on the inverse relationship between calorie information and consumption; meaning that as the calorie information takes smaller values, consumption of unhealthy snack increases. On a practical level, this points out the presence of a licensing effect on consumption of snacks driven by small calorie information. In other words, individual feel allowed and encouraged to consumer more of the unhealthy snack when they see a low amount of calorie on the nutritional label. Probably the reason for such behaviour stems from the theory of disconfirmation discussed in

details in the second chapter of this dissertation. When dividing the sample according to age, this effect was particularly true for the younger age group, composed of respondents having 29 years or less. This might imply that licensing is more powerful for younger generations for which is more difficult to successfully self-control food behaviours with respect to older people. Another possible interpretation is that older people are more successful in making right calorie assessment and are not affected substantially by the disconfirmation effect, while younger people fail to correctly assess snack calories. Overall, some new research must be done to investigate further on these two possibilities.

3.4.1 Theoretical Implications

Literature so fa has investigated if and how nutritional labels influence purchase decision or consumption of food products. A great variety of effects have been found, among which the fact that pre-portioning the package is effective in controlling consumption. Furthermore, in 2019, Tangari et. Al. discovered that a bias in behaviour exists such that , for unhealthy food products, seeing a smaller amount of calories on the nutritional label, driven by providing calorie per portion, might induce people to licensing behaviours, thus increasing consumption. Unfortunately, this work of research cannot provide meaningful implications for the effect of pack on consumption, this because the moderator of the experiment, measuring the interaction of frame and pack, did not result statistically significant. On the other hand, some meaningful insights on the main effect of frame on consumption, can bring major stimulus to the literature so far existing.

As anticipated in the discussion section of the results, the first hypothesis of this dissertation is backed by significant results, suggesting an effect of calorie framing on consumption intention. The new contribution this research brings to past literature is including a three levels frame which has never been investigated before simultaneously. In fact, the recent work performed by Tangari and his team only compares two levels of frame: a reference level, such as the information presented per 100g, and the information per recommended portion. The third level added in this experiment is the frame per unit, which is becoming increasingly popular in Italy, to present the information of unhealthy snacks such as biscuits. For example the brand *Ferrero*, when launching the love product "*Nutella Biscuits*" last November, decided to disclose information per 100g paired with the information per unit of product (expressed in grams). This thesis is the first comparing simultaneously all three levels of frame used by brands nowadays on their snack products. The results as hypnotised and following the lines of Tangari, confirm the inverse relationship between calorie displayed and consumption. In details, if the number of calorie shown decreases, for unhealthy food products, consumption increases because of some form of licensing bias present in consumer's mind. In practice, the fact that

respondents consumed more when they saw the information per unit, with respect to when they saw the information per portion, enlarges the findings of Tangari et. Al. which were limited to comparing the information per portion with a baseline information.
Another new contribution is brought by the fact that the significance of the experiment improved when data were split according to age. Suggesting that the effect was particularly prominent for younger individuals with respect to the older counterpart. This effect has not been investigated deeply, because it is not part of the research question of this thesis, but it can be a starting point for new investigations on the topic. After highlighting the point of differentiation of this thesis and how they could be potentially a cue for developing further the topic, a great number of policy implication potentially exist, which will be discussed further in the following paragraph.

3.4.2 Policy Implications

The findings of this experiment, present possibly meaningful cues for policy makers for what regards the relationship between nutritional information frame and consumption intention of individuals. As previously deepened in chapter one, nutritional labels can be among the nudging tools used by policy makers in order to guide and control consumption. During the decades a number of strategies have emerged regarding nutritional labels such as displaying the nutritional information per serving sizes or alternatively per unit; or the use of the now popular front-of-pack labels.
In 2019 a study made by Tangari and his team suggests that for unhealthy food product, reducing to smaller units the nutritional information could trigger a so called backfire effect. This theory was confirmed and enlarged by this thesis experiment, as already commented in the discussion section of the results. This means that, while a lot of effort has been devoted from a policy perspective to make the nutritional information disclosed as clear as possible, also by showing it in a multitude of frames; from a purely behavioural perspective this might not be beneficial when talking about the category of unhealthy snacks. In fact, evidences suggests, that when consuming unhealthy snacks seeing a small number attached to the caloric information might license the behaviour of individual to eat "just one more"; overall increasing consumption and thus energy intake. Policymakers might be willing, to consider more behavioural cues when designing nutritional labels policies, since has been largely demonstrated the irrational side of individual in front of food choices.
The results, pose the question of wheatear is it truly necessary or beneficial to provide information per portion or per unit on unhealthy snack products; given the fact that it seems like the larger the number of calories in absolute terms, the lower the possibility that licensing behaviour take place. Surely this puzzle creates a difficult trade-off to work upon, namely the one between the need for information disclosure, which materializes in disclosing the information so to be as clear and less

misleading as possible, and the actual behavioural and unconscious response of the individuals to this information, which might sometimes result counterproductive from a consumption amount point of view.

Another original contribution of this work of research, which might pose a thinking effort on policymakers is the fact that all this said is more prominent on younger generations. Findings suggest in fact, that while the creation of a backfire effect happens at all ages, it is particularly prominent for young adults. This might be the result of the inability of the younger sub-group to exert self-control behaviours on food choices, and falling more into the possibility of licensing consumption. From a policy perspective such evidence might be difficult to tackle nudging nutritional labels. This because the presence of nutritional labels is unique for all consumers exposed to it; and distinctions according to changes in responses might be difficult or even impossible to exercise. On the other hand, policy makers might use this findings to promote educational initiatives for the younger generations on the importance of quantity control on overall health.

While writing this dissertation, I understood how designing policies to promote overall wellbeing is surely not an easy task for policymakers, particularly because of the strong presence of irrational biases in behaviour attacking the scheme of food choices of individuals. In fact, the relationship between people and food is extremely personal and difficult to regulate under a unique policy design set. On that note, such experiment results might shed light in policymakers' mind to devote extra attention to behavioural cues, letting behavioural patterns such as the licensing effect bringing to a backfire effect on consumption, to emerge and be scope of further investigation and consideration.

3.5 Limitations and future research

While writing those pages, some limitations of the present study emerged. It is worth to take some time to include those limitations in the last part of this last chapter, in order to acknowledge them and possibly work on them in future works of research.

The first thing useful to mention, even if not properly a limitation, is the change in methodology imposed by the lockdown because of the Covid-19 pandemic. In fact, in the first stages of brainstorming of the methodology with which perform the experiment, the idea was to carry out the study on field in the university cafeteria. Surely, having respondents to actually pick and consume the product instead of imagining to live the situation as described in the scenarios of an online survey would have been beneficial to the experiment's outcome. This to say that it might be interesting to have another graduating student to replicate this experiment, or a slightly modified version of it, on field when circumstances would permit, in order to truly capture the immediate behavioural response to the phenomenon of licensing in food consumption.

Another possible limitation is brought by the sampling method used. We recruited respondents using a snowball sampling technique. This, even if very handy in order to distribute rapidly the questionnaire, pose some problems in terms of biases. In fact, such method can be affected by some form of "community bias", meaning that the sample fails to be representative because a certain sub-group of the population sharing similar characteristics is auto-selected in the process of passing and sharing the survey between people among once sphere of influence. A selection, based on probabilistic sampling techniques, such as simple random sampling, would have worked better to ensure representativeness.

Another possible limitation which emerged from the demographic section of the questionnaire is the higher presence of women in the sample. In fact, 65% of survey respondents were women. This unbalanced presence of both genders might skew results in a given direction. In fact, it is common knowledge that women eat on average less than man, and are more careful with their diets or food choices. Furthermore, the median age of 29 years old suggest that the sample is pretty young. Also such condition of age can have an effect on responses. More in details, the younger generations consume on average more snack products than their older counterpart and might be less attentive to the topic of nutrition.

Lastly, the pack manipulation resulted less efficient with respect to the frame manipulation. This is probably the limitation which affected the outcome of the study the most. In fact, while I devoted great attention in designing the stimuli manipulating the pack (loose pack vs. pre-packed), the pre-packed version resulted less incisive than the loose pack scenario. While designing the questionnaire I tried to make as explicit as possible that in the pre-pack condition, the biscuit box contained 6 singularly packed 3 biscuits portions. From such a manipulation I would have expected a consistent number of respondents choosing to consume 3 biscuits or multiples of three. This expectations steamed from the theory on pre-packed food products, suggesting that opening an additional pack of an unhealthy snack works as a mental and psychological check point to stop consuming. In practice instead, when looking at the data in details a great number of respondents showed inconsistent behaviour both with respect to the literature but also in respect to realistic practice. To make an example a considerable number of people reported consuming 7 biscuits. Such behaviour would imply to open a first pack and finish the first 3 biscuits, open a second pack and consume it entirely as well and open a third pack to consume only one biscuit. Such behaviour is considered very unrealistic or at least rare, while a multitude of respondents answered showing such behaviour.

Future research, or future thesis could, as said before try to investigate how the framing of the nutritional information affects consumption behaviour of unhealthy food products directly on field, thus measuring consumption intention in a real consumption setting, such as a university cafeteria at

lunch time. In such case, a more balanced sample would probably be recruited between males and female, and the investigation would be performed only on a younger population. Future works could also try to correct for the pack manipulation, trying to find possible ways to correctly portray pack differences so to be captured by individuals.

Future research could also try to assess the effect of nutritional framing on consumption intention, moderated by something different than pack. A possible moderator, to replicate such experiment, could be the healthiness of the product. In this case the randomization process would be done by presenting an unhealthy biscuit type and an healthy biscuit type. Another one could be the presence of a front-of-pack label or the presence of an health logo such as the organic certification which is becoming increasingly popular. It might also be interesting to replicate the experiment using as moderator the "battery system" FoP proposed by Italy as a possible implementable FoP

Lastly, but most importantly, future works could implement these findings in a policy context. Trying to design possible policies which take into greater consideration the presence of behavioural inconsistencies, such as the backfire effect on consumption, when deciding which food to purchase and consume.

Conclusions and Acknowledgments

The process of writing this thesis has been an incredible journey which made me capable of mastering the topic of nutritional labels, and let me understand a bit further the mind of individuals with respect to food choices. Even if still a lot should be done in order to truly being able to motivate individuals to follow a correct diet in order to pursue and live a healthy life, I like to think this work as a contributor in exposing to policy makers, the possibility of unwanted biases in behaviour to occur with respect to food choices. Including such biases in the equation will hopefully positively contribute to the battle against the phenomenon of obesity.

This work of research wouldn't have been possible without the incredible team with which I have shared the pleasure to work with. Starting from the Professor Simona Romani, which has been a very caring and attentive advisor, the assistant Antea Gambicorti, extremely knowledgeable on the topic of nutritional labels and especially front-of-pack labels and Martina Troiani an incredible teammate with which I shared moments of discussion, crucial for the resolution of doubts.

I would also like to dedicate few lines of gratitude to my parents, without which I would not be able today to graduate from this university. I take advantage of this space to tell them I am extremely thankful for all the sacrifices they made during these years to allow my journey of self-discovery.

I cannot fail to mention my friends with which I share life: Marta, Claudia, Beatrice, Chiara, Mauro, Giorgione e Giorgino.

Last, but absolutely not least, I dedicate this thesis to the best grandparents in the whole world: Marcella and Nino. I love you from the bottom of my heart and I cannot wait to be able to hug you again.

Thesis Summary

Topic introduction and definition of the relevance

Nowadays there exists a disease so silent that, more often than not, it is not even considered as such by the general public. Obesity is a worldwide problem and data suggest a steady increase in trend over the past century. The problem is particularly severe in the United States of America, but also Europe suffers from what is known as the obesity pandemic. For this reason, policy makers and other institutions understood the importance of a correctly designed body of policies, touching multiple areas of influence, for containing or even battling this problem. Food and its excess consumption are at the base of a matter such as obesity. It seems that people are unbale to correctly perform a quality assessment of the product they purchase and then consume, in terms of health impact. For this reason, a worldwide tool used by policymakers to guide consumption behaviours by providing a wholesome source of information, are nutritional labels. As of now, a great variety of labels are available on the market which as a result created some degree of confusion among individuals. The reason beyond such heterogeneity in labelling designs, stems from the fact that for a long time their adoption has been unregulated and that the design of some of the parts, even nowadays, is left to the preferences of the producers.

If from one side a multitude of different designs exist on supermarket's shelves, it is also true that a multitude of different responses to nutritional labelling tools has been recorded from individuals. This because each individual is different from one another, and so each person responds to the presence of the nutritional labelling differently. Furthermore, it has been demonstrated that when dealing with food and nutrition, people are affected by a multitude of biases in behaviour which in turn affect preferences and consumption.

For all the above stated and more, it is important for policy makers to find ways to match effectively the presence of the nutritional label and the behavioural response of individuals. This thesis finds its relevance in trying to bring behavioural insights, which might result useful for understanding how individual respond to nutritional information framing, to be a starting cue to adapt nutritional labels policy for health goal purposes. This because, at the end of the day, the goal to achieve is instruct people to consume more wholesome, low energy dense food, and less of the unhealthy processed foods. If nutritional labels, directly or in more unconscious ways are able to guide such behaviour effectively, the battle against obesity might become less of a struggle to fight.

This thesis put emphasis on the fact that often behavioural responses actually move against of what expected following straightforward lines of reasoning, because once again, individual are highly irrational with respect to food choices, and policy makers should be extremely aware of that. In the

extended version of the dissertation detailed stats on obesity in Europe as well as in Italy are collected to provide an in depth analysis of the phenomena. Overall, the most salient data for what concerns obesity in Italy suggest that 9,8% of Italians are clinically obese and 35,3% are overweight for a total of more than 25 millions Italians. Obese tendency significantly depend on education and income level; furthermore for the younger generation the eating habits of the parents or more in general, the family background enter the equation. Looking at the opposite side of the spectrum in Italy reports suggest that around 3 millions of Italians suffer from restricting eating disorders; of which the great majority are girls between 15 and 19 years old.

Contribution of the research

The contribution this research wants to bring is to provide a wholesome revision of the use of nutritional labels in Europe to asses where we are now. To test, how differences in the framing of the nutritional information exclusively, affect consumption intentions and lastly to test if controlling the environment by changing the package proposed can successfully manage volume intake. Leveraging on nutritional labels is not the only solution to guide food choices, but surely it is an aspect policy makers can control to promote healthier eating habits. For this reason, I believe the results of this dissertation could potentially be beneficial for policy purposes to help policymaker, but also food producers to realize possible behavioural patterns stemming from nudging nutritional labels. Among the big environmental changes brought by nutritional labels, evidences suggest that the main effect they have was a reformulation of the product made by producers to fit with healthier standards. This effect was stronger than the direct effect nutritional labels have on individuals. It seems that mandatory disclosure of certain nutrients affects diets by forcing food manufacturers, or restaurant and coffee chains, to change the recipe of their products. When looking at the direct effect of food label policies on consumers, policymakers have to find ways for letting costumer respond to new sources of information. To achieve this, it is important to understand behavioural responses of consumers in relation to food labels, then to assess if those are able to encourage consumers to revaluate unhealthy preferences. Assess the outcome of food policies is challenging for different reasons.

Overall, policy actions struggle to succeed for those case in which unhealthy preferences have been already learnt by the individual. In such case, the time span needed for the policy to have some effect will dilute. Furthermore, policy actions will impact different individuals in different ways, making it difficult to come out with a single feedback. Changes in the food environment are also difficult to detect and identify. Overall a successful policy is one which strategically targets and affects food preferences formation not at the individual level, but in relation to the environment (Hawkes C. S.,

2015). This means improving diets both at a local level but also at a global level and among all social classes.

At the individual levels improvements are more difficult to detect since each individual is different and affected in different ways by nutritional labels. The environment and lifestyle the person lives affects the degree to which he or she examines labels. Unfortunately it seems that the pursue of an healthy lifestyle or a dieting journey increases the possibility of labels been read and worked upon. In order for policies to be broadly effective, a deep behavioural investigation on how people respond to them is needed. In this way, labels can be modelled and modified to individuals conscious and unconscious needs to improve their effectiveness.

Overall, the main driver for the development of obesity symptoms is excess consumption of salty snack or sweets. In general the snack category is the one under the spotlight when policy makers think of ways to control obesity. In fact, obese people seem to abuse of snacks, eating them out from their three main meals of the day. Snack consumption, over a single day, can reach higher energy density intake compared to a normal meal. For this reason I chose to focus on the unhealthy snack category, taking as a reference product sweet biscuits, because I believe them might be more impactful for obesity prevention policy purposes.

Policy makers have also to make sure that nutritional labels are highly visible and comprehensible. During the last decade much work has been done to improve visibility, such as the implementation of FoP labels. On the other hand, for what concerns comprehensibility some issues are still there. It seems that differences in socio-economic status also affect the degree to which a person understands the nutritional table. Those differences should be taken into account as well.

The theory behind nutritional labels

Nutritional labels are tables exposed on food packages, stating information about the nutrients inside that particular product. There exist two macro-categories of nutritional labels. Namely "**Nutrition Facts Tables**" and "**Graphical Nutrition Labels**" (Hawkes C. , 2010). Nutrition facts table, popularly called NFT are the most widely used and the oldest ones. They are "box tables" which contain the amount, usually expressed in grams, of the nutrient found inside the food. On the other hand, Graphical nutritional label, or GNL were invented more recently, they rely of graphs or images which make those labels interpretative by nature. NFT are found on the back, or alternatively on the side of the packaging. The box table includes (from left to right), the name of the nutrient, the amount of the nutrient inside the product (usually expressed per 100g) and, in some cases the "percentage of daily value". This last figure is inserted in order to help consumers to place that particular product

inside their overall diet. The "**percentage of daily value**" is the percentage of a particular nutrient contained in 100g or in a portion of the product. In order to correctly assume that nutrient, you should achieve 100% of its intake at the end of the day. Great variances from the recommended value might affect overall health in the long run. A crucial concept of Nutritional Fact Tables is the one of "**Reference Unit**". Using reference units makes the information more customer friendly and permits comparison between food from the same product category or even of different ones. Three types of reference units exists (per 100g/100ml, per serving, per recommended daily amount).

Graphical nutrition labelling was introduced many years later with respect to NFT. The idea of including graphics stemmed from the problem that consumers seemed not understanding easily NFT, especially at the point of purchase. Reasoning on this problem, the aid of graphics seemed a great way to make readability of nutrients more customer friendly. The use of graphics helps to see, read, interpret and act on the label. These type of labels are also known as "interpretative labels". Contrary from NFT they are usually found on the front of the pack, emphasizing even more their visibility. The increasing importance of this format of labels, known as Front-of-pack labelling, has started an entire new stream of research on their effectives, detailed description on FoP can be found in the second chapter of this thesis.

Some problems emerged over the years over the use of nutritional labels, firstly the high presence of a multitude of different labels. A study performed by the European commission[25] (Ipsos, 2013), identified the presence of 901 labels as of 2013. Spain and Italy were the two countries with the higher number of labelling schemes. This incredible amount of data portrayed in different forms, might create confusion in the mind of consumers (Falguera, 2012). Was after the recognition of this problem that Europe started to regulate the huge amount of labels under stringent regulations, but unanimity of labels is far to be agreed upon. Recently a different study performed by the European FLABEL (*Food Labelling to Advance Better Education for Life*) tried to develop a comprehensive label typology which would help member states to categorize and understand all kind of nutritional labels already existing, but also hypothetical ones (Hodgkins, 2009). The typology confirms the inverse relationship between how directive the label instructs consumers about the healthiness of the food, and the amount of nutritional information presented inside the scheme. Three macro-categories have been identified by the project: Non-directive labels, semi-directive labels and Directive labels.

From all the literature on nutritional labels it seem there exist a misalignment in the way people and policy makers perceive nutritional labels. In fact, while policy maker see nutritional label on packaged product as a variable affecting purchasing decisions; individuals tend to see themselves as indirect

[25] Ipsos e London Economics EAHC (2013). Consumer market Study on the functioning of voluntary food labelling schemes for consumers in the European Union EAHC/ FWC/2012 8604 .

beneficiaries of the labels. They perceive to be affected by them because of how the label affects third parties, such as food manufacturer, which because of the label might increase its product quality. People also feel more at ease and trustworthy, participating in an industry where disclosure of information is present. This is in line with the idea that in a world which becomes increasingly frenetic individual accountable for grocery shopping want to shift the burden of accountability, quality and precision to the food industry. Food labels are a medium to make food producers of more accountable (non-use benefit), (R. J. Lenahan, 1973).

Theory supporting the hypothesis

Nutritional labels and portion sizes

The interest over the topic of portion sizes has increased in recent decades because of strong evidences suggesting its positive relationship with body weight[26]. In particular, the use of large portion size increases the energy intake of individuals; and if this surplus perpetuates overtime it could lead to the development of obesity (Young LR N. M., 2002). In 1966 the work of research carried out by Wansink (Wansink, 1996), suggested that the way food is packed affects the amount took by individuals. Looking at the psychological reasons why bigger sizes motivated overeating researchers found the concept of "consumption norms" (Fisher JO, 2003). In particular, individuals perceived the amount of food on a plate or in a given package as the "appropriate" or "ideal" amount over-relying on visual cues. Respondents of different studies increased their snack intake with the increase of the size of the package. Furthermore, it seems coherent to imagine that when people find themselves in situations which are full of distraction, such as eating in restaurants or outdoors, they will show incredibly low levels of attention over portion size, and over-rely on visual cues, which in turn might cause overeating. A common message which passed over the years in order to fight obesity, or more in general maintain a healthier lifestyle, is to "eat less food" overall. Though this might be seen as unsustainable in the long run (Bell EA, 1998). Efforts should be instead translated into letting individuals substitute high-energy dense foods with low-energy dense ones, thus controlling for the portion size effect. Among the control tools to manage portion sizes we find information (in Italy implemented thanks to the work of the SINU) and the modification of the environment in a way people are not exposed to large portion sizes as often, such as the use of pre-portioned food.

[26] Dietary Guidelines Advisory Committee. Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 2010, to the Secretary of Agriculture and the Secretary of Health and Human Services. U.S. Department of Agriculture, Agricultural Research Service, Washington, DC, 2010

The possible effects of pre-packaged portions

Often when food is pre-portioned in singular serving sizes, producers decide to disclose the caloric information per-serving. Tangari, in his work of research on snacks (Tangari, 2019), suggests that the way the information is shown on the package can actually affect consumption behaviour. Snack consumption, due to the high caloric intake (if considered as a single meal over a single day), can affects weight control (Haws, 2017). Looking at disconfirmation theory (Oliver, 1977) applied to consumption of unhealthy snacks we imagine that information which is better than what we expected, can instigate what we call a "backfire effect" leading to increased consumption driven by an increase in the evaluation of the product (Grunert, 2005). The generation of a backfire effect is not uncommon because manufacturer choose to display the smallest serving size legally authorized (Mohr, 2012), and also because people tend to pay attention to labels for unhealthy food much more than for healthy foods (Mishra, 2011). Another stream of literature (Andrew B. Geier, 2006), suggests instead that individual are affected by a heuristic called *unit bias*. This applied to food consumption means that a defined food unit (within a range of functional units) is considered the appropriate amount to consume. This unit can be determined by pre-packed products or by the amount of food people find inside their plates at a restaurant. Cultural factors (Herman, 2005) come into play when we talk of unit bias since they determine a consumption norm to be applied (Wansink B. , 2004).

Food type vs. food quantity

When we refer to a "type choice" we mean choice between a more healthy food versus a less healthy food (Dhar R, 1999); instead, when we speak of "quantity choice" on the other hand, research mostly focuses on understanding the perception people have of portion sizes. In the mind of consumers it seems, following a multitude of works of research, that food which type results a primary dimension with respect to quantity. One possible explanation resides in the order in which people process information (Hogarth, 2001). Hogarth suggest that in general, categorical attributes are processed first with respect than continuous attributes. For this reason food type, which is a categorical attribute, is processed first by default in the mind of consumers. Food is often assigned a category such as: healthy or unhealthy, good or bad. This type of categorization greatly affects judgment and consequently drives decision making (Peeters G, 2002). What follows from this strict categorization is the fact that quantity assessment are often shadowed and food type assessments are often used as an anchor guiding decision (Epley N, 2006).

Present research

The research question this dissertation wants to answer is: how the framing of the nutritional information (100g/unit/portion) affects the consumption intention of unhealthy snacks when moderated by the packaging of the product (loose vs. prepack). And the two hypothesis designed in order to answer the research question are the following:

> **H1:** Provide calorie information of unhealthy snack per 100g paired with unit (g), rather than per 100g paired with portion (g), increases the individual's consumption intention for the unhealthy snack category.
>
> **H2**: The proposed packaging (loose vs. pre-packed) moderates the relationship between the framing of the calorie information and consumption intention. In particular, the effect of the 100g information paired with the unit information in strengthened in case of a loose pack, while it is weakened in case of a pre-packaged snack.

Experiment design & analysis

In order to test the two hypothesis described above, an online survey experiment was designed. Data were collected through a questionnaire and using a snowball sampling technique. Six scenarios were prepared, forming a 3x2 matrix, having three frames (100g, 100g+unit, 100g+portion) and two packaging design (loose vs. pre-pack). After cleaning the data the final number of respondents were 455 people; among which 156 were male and 299 female. Looking at age, mean sample age was 36,5 years old while median age dropped to 29 years old. Demographics are described in more details in the full version of the dissertation, including differences by scenario as well.

After the data cleaning was performed, the data set was ready to be analysed. The analysis carried out is a two-way ANOVA. Before running the model, some manipulations of the variables were necessary. Firstly, I needed to check the reliability of the multi-items scales. This was measured looking at the Cronbach Alpha coefficient. In particular I had three multi-items scales inside my questionnaire: a "consumption propensity" scale composed by three items, a "nutrition interest" scale made by two items, and a three items "health concern" scale. All the three scales were internally consistent satisfying the minimum level of 0.7 and not going above 0.95. In particular, the Cronbach alpha for the "propensity to consume" scale is equal to 0,932, the one for the "nutrition interest" scale is 0,949 and the one for the "health concern" scale is equal to 0,794.

After ensuring the reliability of all three multi-items scales I could compute the three new variables coded as "nutrition interest", "consumption" and "health". Among those, consumption is the dependent variable of analysis.

The next preparatory step before computing the two-way ANOVA is to recode respectively the independent variable "nutritional information framing" and the moderating variable "packaging". The first became the variable "frame" taking values of 0 when the information was presented per 100g, 1 when the information was presented per 100g + per portion (30g) and 2 when the information was presented per 100g + per unit (9g). The second variable was recoded as a dummy variable "pack" taking values 0 when the pack saw was loose and 1 when the pack was pre-portioned.

After completing the preparatory steps, I run the two-way ANOVA using the univariate model from SPSS.

Once again, the model was constructed with consumption as the dependent variable, frame having three levels as the independent variable and lastly pack as the moderator of the analysis, coded as a dummy variable 0-1. The goal of the analysis was to investigate on both the main effect of the independent variable on the dependent variable, namely if the way in which nutritional information is framed affects consumption intention; but also if the pack moderates this relationship and if so in which direction. Looking at the interaction effect first, unfortunately the p-value of the interaction between frame and pack in greater than 0.05 thus not statistically significant, in other words the effect of nutritional information frame on consumption doesn't differ nor changes depending on how the product is packed. Similarly, the effect of pack on consumption is not statistically significant (p-value = 0.145), making me incapable of inferring the effect of pack on consumption on its own.

For this reason I shift the attention on the main effect of frame on consumption. The p-value is smaller than 0.05 suggesting a significant effect of nutritional information framing on consumption intention. In other words, the way in which the information is framed affects consumption. In fact, we can see that consumption increases moving from zero to two. In particular, mean consumption is equal to 3,7 biscuits when the information is presented per 100g solely, 3,8 biscuits when the information is presented per 100g and per recommended portion and 4 biscuits when the information is presented per 100g and per unit. This findings confirm the first hypothesis presented in this dissertation suggesting an increase in consumption of unhealthy food product as the absolute level of calorie information decreases, as the result of a possible backfire effect of consumption driven from licensing behaviours.

Going more in depth on the significance of the main effect, I investigated it according to age, suspecting differences among age group. I decide to take as the reference age to split the sample the median age of 29 years old. And I re-run the analysis with the selected data. Among the 455 participants, 230 of them were below 29 years old or were exactly 29. While the interaction effect remains not statistically significant, the significance on the main effect of frame improves for the youngest sub-sample. In fact, the p-value is below 0.05 (= 0,021), suggesting that, for this age group,

the way in which the nutritional information is framed affects consumption intention to a greater extent. More in details, consumption increases from 0 (100g) to 2 (100g + unit) satisfying our first hypothesis. Mean consumption is equal to 3,9 biscuits when the information is presented per 100g solely, 4,3 biscuits when the information is presented per 100g and per recommended portion and 4,6 biscuits when the information is presented per 100g and per unit. Overall, comparing mean among the two age groups suggests that young individuals consume more biscuits than the older sub-sample for all three scenarios, which paired which the improvement in significance level might signify the poorer ability of the younger generation to self-control themselves when choosing the amount of unhealthy snacks to consume.

Discussion and implications

In order to discuss in depth the results, I want first to check the mean levels of the control variables inserted in the questionnaire, to see the preferences of the respondents regarding topics which potentially might impact food consumption behaviour. Once again, the stimuli used for this dissertation were biscuits, so I wanted to have an idea of how biscuits were perceived by the sample. On a 7-points Likert scale, biscuits scored pretty high in likeability. In fact, the mean score for the likeably variable, measuring how much people liked biscuits, is 4,74. In line with people preferences, respondents declared to consume biscuits from 2 to 3 times a week, which corresponds to the fifth point on a 7-points Likert scale. A high level of preference for biscuits as well as a high frequency of consumption were auspicial, suggesting familiarity with the product which in this case probably helped respondents visualize the scenario presented in the survey.

A measure for the perceived healthiness of the product was inserted to see if respondents would assign biscuits to the unhealthy snack category. As expected, when asked how healthy on a 7-points Likert scale they perceive the product to be, the mean recorded value was 2,62 which suggest that rightly people perceive biscuits to be an unhealthy snack.

Both nutrition interest, measured asking individuals how often do they devote attention to calories and calorie information; and the concern of health, measured asking respondents how preoccupied are they of gaining weight, developing high blood pressure and cardiovascular diseases, scored mean values lying in the middle of the scale. In particular, health concern scored 4,4 and nutrition interest scored 4,5, suggesting that the respondents were not very polarized regarding health and nutrition, but showed only a slight interest in those topics.

Lastly, as mentioned by Tangari et. Al. (Tangari, 2019), I also wanted to investigate hunger at the time of completion of the questionnaire. This because, when measuring food consumption, the level of hunger will probably affect quantity consumed, in particular of unhealthy snacks. The mean level

of hunger for this sample was 2,71. I am happy with a lower level of hunger assessment because it means that people did not overestimate their answers due to hunger. Such a low level let me hope that a more rational decision-making process has been used while answering the survey.

Now, I can discuss the results in light of the mean levels of the control variables. Unfortunately, nothing can be said about the interaction effect of frame and pack which is not statistically significant from our analysis. The manipulation of the pack resulted very tricky to perform using an online survey method, and possibly results will be much different if the same experiment, manipulating the biscuits' packaging, is done on field.

On the other hand, the main effect of frame on consumption resulted statistically significant, satisfying fully the first hypothesis of this dissertation. This finding is of great importance for multiple reasons. Firstly, it confirms the theory of Tangari et. Al. (Tangari, 2019), suggesting the creation of a backfire effect when calorie information on unhealthy snack are presented in smaller units, giving the impression of assimilating a lower calories intake. Secondly, it deepens the findings of Tangari. This because Tangari experiment compares calorie information per 100g with calorie information per recommended portion of the snack. This thesis goes a step beyond, designing a 3 levels frame comparing both the 100g information, with the information per portion and the information per unit, which shows a still smaller calorie level compared to the portion. In all the three cases calories are shown in grams enabling a better comparison and consistency among the three frames. As we expected from Tangari studies individual consumed more when the information was given per portion with respect to when the information was give per 100g. Then we discovered that individual consumed even more when the information was given per unit with respect to when it was given per portion. This findings, shed light on the inverse relationship between calorie information and consumption; meaning that as the calorie information takes smaller values, consumption of unhealthy snack increases. On a practical level, this points out the presence of a licensing effect on consumption of snacks driven by small calorie information. In other words, individual feel allowed and encouraged to consumer more of the unhealthy snack when they see a low amount of calorie on the nutritional label. Probably the reason for such behaviour stems from the theory of disconfirmation discussed in details in the second chapter of this dissertation. When dividing the sample according to age, this effect was particularly true for the younger age group, composed of respondents having 29 years or less. This might imply that licensing is more powerful for younger generations for which is more difficult to successfully self-control food behaviours with respect to older people. Another possible interpretation is that older people are more successful in making right calorie assessment and are not affected substantially by the disconfirmation effect, while younger people fail to correctly assess

snack calories. Overall, some new research must be done to investigate further on these two possibilities.

3.4.1 Theoretical Implications

Unfortunately, this work of research cannot provide meaningful implications for the effect of pack on consumption, this because the moderator of the experiment, measuring the interaction of frame and pack, did not result statistically significant. On the other hand, some meaningful insights on the main effect of frame on consumption, can bring major stimulus to the literature so far existing.

As anticipated in the discussion section of the results, the first hypothesis of this dissertation is backed by significant results, suggesting an effect of calorie framing on consumption intention. The new contribution this research brings to past literature is including a three levels frame which has never been investigated before simultaneously. In fact, the recent work performed by Tangari and his team only compares two levels of frame: a reference level, such as the information presented per 100g, and the information per recommended portion. The third level added in this experiment is the frame per unit, which is becoming increasingly popular in Italy, to present the information of unhealthy snacks such as biscuits. For example the brand *Ferrero*, when launching the love product "*Nutella Biscuits*" last November, decided to disclose information per 100g paired with the information per unit of product (expressed in grams). This thesis is the first comparing simultaneously all three levels of frame used by brands nowadays on their snack products. The results as hypnotised and following the lines of Tangari, confirm the inverse relationship between calorie displayed and consumption. In details, if the number of calorie shown decreases, for unhealthy food products, consumption increases because of some form of licensing bias present in consumer's mind. In practice, the fact that respondents consumed more when they saw the information per unit, with respect to when they saw the information per portion, enlarges the findings of Tangari et. Al. which were limited to comparing the information per portion with a baseline information.

Another new contribution is brought by the fact that the significance of the experiment improved when data were split according to age. Suggesting that the effect was particularly prominent for younger individuals with respect to the older counterpart. This effect has not been investigated deeply, because it is not part of the research question of this thesis, but it can be a starting point for new investigations on the topic. After highlighting the point of differentiation of this thesis and how they could be potentially a cue for developing further the topic, a great number of policy implication potentially exist, which will be discussed further in the following paragraph.

3.4.2 Policy Implications

The findings of this experiment, present possibly meaningful cues for policy makers for what regards the relationship between nutritional information frame and consumption intention of individuals. As previously deepened in chapter one, nutritional labels can be among the nudging tools used by policy makers in order to guide and control consumption. During the decades a number of strategies have emerged regarding nutritional labels such as displaying the nutritional information per serving sizes or alternatively per unit; or the use of the now popular front-of-pack labels.

In 2019 a study made by Tangari and his team suggests that for unhealthy food product, reducing to smaller units the nutritional information could trigger a so called backfire effect. This theory was confirmed and enlarged by this thesis experiment, as already commented in the discussion section of the results. This means that, while a lot of effort has been devoted from a policy perspective to make the nutritional information disclosed as clear as possible, also by showing it in a multitude of frames; from a purely behavioural perspective this might not be beneficial when talking about the category of unhealthy snacks. In fact, evidences suggests, that when consuming unhealthy snacks seeing a small number attached to the caloric information might license the behaviour of individual to eat "just one more"; overall increasing consumption and thus energy intake. Policymakers might be willing, to consider more behavioural cues when designing nutritional labels policies, since has been largely demonstrated the irrational side of individual in front of food choices.

The results, pose the question of wheatear is it truly necessary or beneficial to provide information per portion or per unit on unhealthy snack products; given the fact that it seems like the larger the number of calories in absolute terms, the lower the possibility that licensing behaviour take place. Surely this puzzle creates a difficult trade-off to work upon, namely the one between the need for information disclosure, which materializes in disclosing the information so to be as clear and less misleading as possible, and the actual behavioural and unconscious response of the individuals to this information, which might sometimes result counterproductive from a consumption amount point of view.

Another original contribution of this work of research, which might pose a thinking effort on policymakers is the fact that all this said is more prominent on younger generations. Findings suggest in fact, that while the creation of a backfire effect happens at all ages, it is particularly prominent for young adults. This might be the result of the inability of the younger sub-group to exert self-control behaviours on food choices, and falling more into the possibility of licensing consumption. From a policy perspective such evidence might be difficult to tackle nudging nutritional labels. This because the presence of nutritional labels is unique for all consumers exposed to it; and distinctions according to changes in responses might be difficult or even impossible to exercise. On the other hand, policy

makers might use this findings to promote educational initiatives for the younger generations on the importance of quantity control on overall health.

While writing this dissertation, I understood how designing policies to promote overall wellbeing is surely not an easy task for policymakers, particularly because of the strong presence of irrational biases in behaviour attacking the scheme of food choices of individuals. In fact, the relationship between people and food is extremely personal and difficult to regulate under a unique policy design set. On that note, such experiment results might shed light in policymakers' mind to devote extra attention to behavioural cues, letting behavioural patterns such as the licensing effect bringing to a backfire effect on consumption, to emerge and be scope of further investigation and consideration.

3.5 Limitations and future research

While writing those pages, some limitations of the present study emerged. It is worth to take some time to include those limitations in the last part of this last chapter, in order to acknowledge them and possibly work on them in future works of research.

The first thing useful to mention, even if not properly a limitation, is the change in methodology imposed by the lockdown because of the Covid-19 pandemic. In fact, in the first stages of brainstorming of the methodology with which perform the experiment, the idea was to carry out the study on field in the university cafeteria. Surely, having respondents to actually pick and consume the product instead of imagining to live the situation as described in the scenarios of an online survey would have been beneficial to the experiment's outcome. This to say that it might be interesting to have another graduating student to replicate this experiment, or a slightly modified version of it, on field when circumstances would permit, in order to truly capture the immediate behavioural response to the phenomenon of licensing in food consumption.

Another possible limitation is brought by the sampling method used. We recruited respondents using a snowball sampling technique. This, even if very handy in order to distribute rapidly the questionnaire, pose some problems in terms of biases. In fact, such method can be affected by some form of "community bias", meaning that the sample fails to be representative because a certain sub-group of the population sharing similar characteristics is auto-selected in the process of passing and sharing the survey between people among once sphere of influence. A selection, based on probabilistic sampling techniques, such as simple random sampling, would have worked better to ensure representativeness.

Another possible limitation which emerged from the demographic section of the questionnaire is the higher presence of women in the sample. In fact, 65% of survey respondents were women. This unbalanced presence of both genders might skew results in a given direction. In fact, it is common

knowledge that women eat on average less than man, and are more careful with their diets or food choices. Furthermore, the median age of 29 years old suggest that the sample is pretty young. Also such condition of age can have an effect on responses. More in details, the younger generations consume on average more snack products than their older counterpart and might be less attentive to the topic of nutrition.

Lastly, the pack manipulation resulted less efficient with respect to the frame manipulation. This is probably the limitation which affected the outcome of the study the most. In fact, while I devoted great attention in designing the stimuli manipulating the pack (loose pack vs. pre-packed), the pre-packed version resulted less incisive than the loose pack scenario. While designing the questionnaire I tried to make as explicit as possible that in the pre-pack condition, the biscuit box contained 6 singularly packed 3 biscuits portions. From such a manipulation I would have expected a consistent number of respondents choosing to consume 3 biscuits or multiples of three. This expectations steamed from the theory on pre-packed food products, suggesting that opening an additional pack of an unhealthy snack works as a mental and psychological check point to stop consuming. In practice instead, when looking at the data in details a great number of respondents showed inconsistent behaviour both with respect to the literature but also in respect to realistic practice. To make an example a considerable number of people reported consuming 7 biscuits. Such behaviour would imply to open a first pack and finish the first 3 biscuits, open a second pack and consume it entirely as well and open a third pack to consume only one biscuit. Such behaviour is considered very unrealistic or at least rare, while a multitude of respondents answered showing such behaviour.

Future research, or future thesis could, as said before try to investigate how the framing of the nutritional information affects consumption behaviour of unhealthy food products directly on field, thus measuring consumption intention in a real consumption setting, such as a university cafeteria at lunch time. In such case, a more balanced sample would probably be recruited between males and female, and the investigation would be performed only on a younger population. Future works could also try to correct for the pack manipulation, trying to find possible ways to correctly portray pack differences so to be captured by individuals.

Future research could also try to assess the effect of nutritional framing on consumption intention, moderated by something different than pack. A possible moderator, to replicate such experiment, could be the healthiness of the product. In this case the randomization process would be done by presenting an unhealthy biscuit type and an healthy biscuit type. Another one could be the presence of a front-of-pack label or the presence of an health logo such as the organic certification which is becoming increasingly popular. It might also be interesting to replicate the experiment using as moderator the “battery system” FoP proposed by Italy as a possible implementable FoP for Europe.

Lastly, but most importantly, future works could implement these findings in a policy context. Trying to design possible policies which take into greater consideration the presence of behavioural inconsistencies, such as the backfire effect on consumption, when deciding which food to purchase and consume.

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