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# **A qualitative study on the drivers and barriers of university students towards the consumption of plant-based food**

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## Abstract

The rising global production and consumption of meat are posing serious threats in terms of environmental sustainability, public health, and animal-welfare. Increasing evidence demonstrates that dietary habits of Western societies are factors contributing to environmental pollution and degradation and leading towards an improved incidence of chronic diseases. Additionally, to face the rising global population, several dietary guidelines are recommending a shift towards healthier dietary habits including an improved consumption of plant-based foods. Several food industries are continually looking forward to manufacture new alternatives to promote a greater consumption of plant-derived proteins. As a result of the increasing concerns from consumers, several vegetarian and vegan products have started to appear on the shelves of supermarkets, including plant-based meat substitutes. However, although the market share of these products is growing, it is still limited, especially when compared to meat. Therefore, the objective of this thesis is to explore and analyse the major drivers and barriers affecting the consumption of plant-based foods – veggie burgers and meat analogues – and how these could differ among consumers according to their dietary habits. For this purpose, semi-structured and in-depth interviews were carried out for thirty university students. Participants were divided into three categories corresponding to their dietary habits relatively to the consumption of these alternatives: omnivorous not consuming plant-based, omnivorous eating plant-based, and vegetarians consuming plant-based. Based on the research findings, the drivers and barriers differ among consumer groups and type of products. The environmental, health, and animal-welfare awareness is the leading motivation favouring the consumption of these alternatives, even if different involvements characterise the three samples: animal-welfare concern does not represent a driver for omnivorous students frequently consuming meat. The main barriers especially concern meat analogues, which are perceived unfamiliar, highly processed, and expensive.



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# Chapter 1

## Introduction

### 1.1 Background to the study

Meat plays a key role in human evolution. Studies confirm that meat strongly supported the development of brain and man's intellectual capacities, together with other morphological features of human body [1, 2]. The evolution of human diet has been investigated by several scientific studies finding a gradual decrease in the consumption of low-calorie vegetable products in favour of more caloric animal foods. The diet of Homo Sapiens was originally purely carnivorous [3, 4]. Meat is known for its high nutritional value, representing one of the most valuable sources of nutrients [1]. The growing demand especially in Western countries symbolises that meat still covers a central role in human's diet [5].

As outlined in the OECD-FAO Agricultural Outlook 2021-2030 [6], global meat production is expected to increase up to 44 million of tons, reaching 373 metric tons by 2030, and 455 metric tons by 2050. Developing countries lead the trend: 84% of the rising production is attributable to them, with China being the largest meat producer. The growth of global meat supply is not the same across all the sectors; due to the lower FCR value - feed conversion ratio - and so higher efficiency, and the shorter production cycle, poultry meat ranks first in terms of production. As for beef meat, its production is expected to slowly grow due to a change in consumers preferences that are towards poultry meat.

The rise in meat production is a direct consequence of the increasing de-

mand for meat consumption, which is expected to grow by 14% by 2030. Several reasons justify this positive trend, among which population growth plays a significant role. Indeed, the world's population is expected to rise by 11% in 2030, reaching 8.6 billion of people and 9.8 billion in 2050 [7], therefore a consequent growth in meat consumption has been estimated to face this trend [6]. Economic growth is another element affecting meat consumption. Generally, with the rise of incomes there is an increase in meat consumption, as it provides high quality proteins [8]. Furthermore, as economies develop, imports and exports of agricultural products improve contributing to lower the prices; this enables the increase in demand for meat products [9]. However, meat consumption's trend cannot be considered linear with economic growth: studies show that the trend follows an "inverted U-shape". It indicates that in a growing economy, a rise in meat consumption is often noticeable, while in higher income countries, the trend is slightly negative or stable [10, 11].

Even though meat has always been a staple food in Western diets, increasing evidence shows that these dietary patterns are leading towards negative consequences in terms of environmental impact, human health, and ethical issues related to animal welfare [12–14]. Specific policies combining public health nutrition and environmental sustainability are needed to apport beneficial changes in consumers behaviours. Indeed, various research have shown that a reduction of greenhouse-gas intensive animal-based foods, namely meat and dairies, can lead to health and environmental benefits [14, 15]. Furthermore, shifting towards plant-based dietary patterns should be recommended and emphasised by nutrition policies to face the future challenge of feeding the growing global population. [16, 17].

As a consequence, the development of new sources of proteins as viable alternatives to conventional meat has been proposed [18–20]: extensive research is currently being devoted to cultured-based meats and plant-based meats, aiming at mimicking the organoleptic and nutritional properties of meat. Other alternative source of proteins are fungi, algae, and insects [12, 19]. With regard to plant-based meat, traditional plant-based foods including tofu, tempeh and seitan boasts ancient origins, being part of the diet of ancient Asian civilizations [10, 12, 13, 123]. Conversely, novel generation of plant-based meat

analogues (PBMA) have been recently developed with the aim to mimic conventional meat in terms of appearance, organoleptic characteristics, and nutritional value [21]. Because of the resemblance to meat, novel PBMA have been created to appeal omnivorous consumers [12,112].

Even though the demand for plant-based meat substitutes is expected to slowly grow in the coming years, the market share covered only 1% of total meat shares in 2020. Indeed, consumers' preferences are mostly towards meat products [6]. As a consequence, extensive literature has reviewed the factors positively and negatively influencing the consumption of plant-based alternatives. Findings show that consumers choose plant-based food for several reasons, among which environmental, health, and animal-welfare concerns are the leading factors. Additionally, food curiosity, hedonic attributes, ease of preparation, and convenience are drivers facilitating the consumption of plant alternatives. However, several barriers have been identified as well. Taste preferences, food neophobia, unfamiliarity, perceived unavailability, high prices, lack of variety, lack of information and of cooking skills are major drivers limiting the consumption of plant-based food.

## 1.2 Research aims and questions

The objective of this thesis is to explore and analyse the principal factors facilitating and limiting the consumption of plant-based foods, hence the drivers & barriers, and how these could differ according to the dietary habits of consumers. The perception of different groups of individuals regarding vegetarian alternatives – veggie burgers and meat analogues – is further analysed. For this purpose, extensive literature reviewing the drivers and barriers regulating the consumption of plant-proteins alternatives was taken into consideration.

This thesis seeks to answer the following three questions *Q1*, *Q2*, *Q3* relatively to the perception of plant-based products.

- Q1*. Which are the drivers toward the consumption of plant-based meat substitute? What motivates individuals to consume it?
- Q2*. Which are the barriers against the consumption of plant-based meat substitute? What demotivates individuals to consume it?

*Q3.* Which is the perception of consumers toward plant-based products?  
How do they differ among participants?

## 1.3 Methods and scope

The aim of the study is to explore the perception and attitude of consumers regarding plant-based products. For this purpose, qualitative method was chosen over the quantitative approach. Specifically, in-depth interviews were carried out for a sample of thirty respondents. This approach allows the interviewer to gather insightful and subjective answers from participants, reaching the root causes of certain behaviours which could further explain the dietary choices of individuals. In this regard, a semi-structured questionnaire was developed to allow greater flexibility by including follow-up question, and so to personalise the interview. A sample of thirty university students living in Veneto was selected, and equally distributed in three categories according to their dietary habits in relation to the consumption of plant-based products. Precisely: omnivorous not consuming plant-based foods, omnivorous consuming plant-based foods, and vegetarian consuming plant-based foods. Interviews were individually carried out face-to-face or via the Zoom platform. Since the qualitative interview may not be sufficient to analyse the real perception of consumers, the laddering technique and means-end chain methodology together with the picture-sorting technique were further employed.

## 1.4 Dissertation structure

### Chapter 1: Introduction

Chapter 1 presents a brief summary of the current meat market, highlighting the negative impacts on environmental sustainability, public health, and animal-welfare. In this respect, plant-based products could offer a more sustainable, animal-friendly, and healthier alternative to meat. Indeed, the research community is looking for new food technologies to meet this request. A greater focus is on plant-based meat alternatives, which have been recently developed to attract not only vegetarians and vegans, but also omnivorous consumers. In this chapter, the research aims and research questions, together

with the methodology and the structure of the dissertation are summarised.

### **Chapter 2: Literature Review**

Chapter 2 includes a comprehensive review of the academic literature in line with the research questions of this thesis. This chapter aims at analysing six topics, including a general overview of plant-based foods, their environmental, health, and animal-welfare benefits, the drivers and barriers towards their consumption, and the concept of value-action gap.

### **Chapter 3: Research Methodology**

An analysis of the research methodology is discussed in Chapter 3. The choice of the method of qualitative interview over the quantitative one will be explained, together with the two techniques employed in the research, namely laddering interviews through the means-end chain approach and picture-sorting technique. The population sample will be described, together with the interview guide.

### **Chapter 4: Research findings and Discussion**

In Chapter 4, the analysis and discussion of the data gathered through the interviews is carried out. This chapter is divided in six sections in line with the structure of the questionnaire. The drivers and barriers of plant-based products are outlined as a result of the analysis of the eating habits and the consumption and the perception of interviewees through the use of the means-end chain methodology and picture-sorting technique.

### **Chapter 5: Conclusions, Limitations, and Recommendations**

Chapter 5 presents the conclusion, the limitations, and recommendations for future research. Additionally, suggestions to companies marketing plant-based food are expressed on the basis of the findings of this research.



# Chapter 2

## Literature Review

### 2.1 Plant-based products

#### 2.1.1 What is plant-based: plant-based diet, veggie burgers and plant-based meat analogues

‘Plant-based’ is a generic term often referring to a diet or food. Therefore, to provide a comprehensive description of the subject of the thesis, the definitions of plant-based diet, veggie burger and plant-based meat analogue will be discussed below.

The term ‘plant-based diet’ refers to the consumption of “minimally processed fruits, vegetables, whole grains, legumes, nuts and seeds, herbs, and spices and excludes all animal products, including red meat, poultry, fish, eggs, and dairy products” [22]. People following a plant-based diet can be classified in different categories, among which the most common are vegetarians, vegans, and flexitarians. [23, 25] The element that distinguishes the vegetarian diet is the consumption of animal origin derivatives. Indeed, products including dairies and eggs are still part of the vegetarian diet, while meat, poultry, fish, and seafood are excluded. Therefore, in the vegan diet all the foods mentioned above are excluded [26]. The flexitarian diet, also called “semi-vegetarian”, comprises all the individuals primarily following a vegetarian diet but occasionally consuming meat or fish [23].

Nowadays, there is a wide variety of plant-based products. The plant-based categories of foods and drinks are milk, meat, creamer, meals, ice-cream

and frozen goods, yogurt, cheese, protein liquids and powder, butter, ready-to-drink beverages, bars, tofu and tempeh, condiments, sauces, and eggs [24]. Since the subjects of the thesis are veggie burgers and plant-based meat substitutes, only these two products will be analysed.

The term ‘veggie burger’ refers to a burger obtained by mixing different ingredients, including vegetables, legumes, tubers, wholegrains, cereals, and spices [27]. For instance, Valsoia® commercialises a burger made of soy, potatoes, peas, carrots, and corn [104]. These types of burgers can be vegetarian or vegan, depending on the ingredient formulations; indeed, it may be possible to find egg white used as a binder [29] thus making the burger suitable to vegetarian consumers. Another characteristic is that veggie burgers do not aim at resembling meat since they are simply obtained by mixing together different ingredients from plants. For this reason, it is possible to find in the shelves of supermarkets a wide variety of products, characterised by having different flavours according to the ingredients used and hence being able to satisfy different tastes and needs of consumers [27]. Currently in Italy the main brands commercialising this product are Io Veg, Sojasun, Natura Nuova BIO, Findus, Valsoia, and KioEne [30].

The term ‘plant-based meat’ indicates a product processed in such a way as to resemble conventional meat in terms of texture, flavour, appearance, and nutritional value [21,31]. Several appellations are often used to describe plant-based meat alternatives, as meat analogue, faux meat, imitation meat [27,31]. Even though both burgers are manufactured starting from plant proteins, their formulations often differ. Indeed, peculiar ingredients and advanced food technologies are needed for the creation of a plant-based product resembling meat [27]. Extensive literature review was examined for both veggie burgers and meat analogues. However, during the interviews, more data relatively to veggie burgers was gathered. Although it has been recorded a 25.8% increase in sales of plant-based products between 2019 and 2020 [32], the consumption of these alternatives is still limited among Italian consumers [33]. Further research is needed to analyse in more detail the perception of the novel generation of plant-based meat substitutes (PBMS).

## 2.1.2 Evolution of plant-based meat alternatives

According to the author He et al.(2020) [12], it is possible to differentiate between three categories of plant-based meat: traditional, first generation and new generation of plant-based meat.

### **Traditional plant-based meat substitutes**

Traditional plant-based substitutes refer to products as tofu, seitan, and tempeh. Their use dates back thousands of years and is typical of Asian civilization, in particular Chinese and Indian cultures [10,12,13,21]. Tofu and tempeh are simple derivatives from soybeans [10] produced using two different methods of preparation [12]; the major difference between them is that tempeh is obtained by fermenting soybeans, while tofu does not require any fermentation process [34]. For producing seitan, wheat gluten proteins are used instead of soybeans proteins [12, 13]. To manufacture this food, wheat flour is washed until reaching a product with a chewy consistency [13]. A valuable property of seitan is that it can be manipulated to resemble meat products [12].

Shurtleff & Aoyagi (2014) provided a comprehensive list of documents regarding meat substitutes reported in chronological order [35]. The first known reference of tofu is found in the Chinese document Ch'ing I Lu, written by Tao Ku in 965 CE. The authors cite a passage that has been translated into English: "When Shi Ji was the magistrate of Qing Yang, he emphasized the virtue of frugality among the people, and discouraged the consumption of meat. Instead he promoted the sale of tofu (doufu), which gains the sobriquet, 'mock lamb chops or 'the vice major's mutton'." [35]. According to this passage, doufu (tofu) was a cheaper alternative to meat and it was proposed to promote frugality among people and to encourage a reduction in meat consumption. Originally, these traditional plant-based meat alternatives were not considered meat substitutes, but rather part of various vegetarian dishes typical of those countries of origin. Even today, tofu, seitan, and tempeh are consumed as proteins alternatives in Asian civilizations.

### **First generation of plant-based meat alternatives**

The introduction in the Western market of the novel meat analogue is quite recent, dating back to the beginning of 1960s [36]. Due to an increased num-

ber of vegetarians, new products started to be commercialised, as in the case of TVP - texturized vegetable proteins [12]. TVP can be defined as “fabricated palatable food ingredients processed from edible protein source, including among others soy grits, soy protein isolates, and soy protein concentrates with or without suitable option ingredients added for nutritional or technological purposes. They are made up as fibers, shreds, chunks, bits, granules, slices or other forms. When prepared for consumption by hydration, cooking, retorting or other procedures, they retain their structural integrity and characteristic ‘chewy’ texture” [37]. The characteristic contributing to the popularity of TVP is their ability to meet different textures according to the processing method. For instance, the extrusion process is employed to change the TVP’s structure, making it more fibrous, with the aim to resemble meat texture. Not only the appearance of TVP could be modulated, but also the organoleptic characteristics: by adding additives and specific ingredients, different tastes are obtained [38] for the production of patties, stews and sauces [36].

### **New generation of plant-based meat alternatives**

What limits the consumption of traditional and first generation of plant-based meat alternatives is primarily their taste and the appearance. Actually, most vegetarians and vegans positively accept traditional meat substitutes such as tofu, seitan and tempeh as these do not recall the taste of meat; conversely, several meat-eaters and meat-lovers do not find this type of food appetizing [12, 39]. For this reason, novel meat analogues have been developed in order to attract a wider range of consumers, namely meat reducers and flexitarians [40, 41].

In the last decade companies as Impossible Food™, Beyond meat™ and Lightlife™ were able to develop plant-based meat replacers that mimic the appearance, texture, nutritional value and especially the taste of meat [12]. Advanced food technologies have been practiced for years with the aim to create a fibrous texture mimicking the one of meat. Extrusion, shearing, spinning, and mixing are the most used technologies to fulfil this purpose [42], and soy proteins, wheat gluten, egg and milk proteins are the major ingredients used for their manufacture [43].

### 2.1.3 Alternative source of proteins to meat

Even though this thesis focuses on plant-based meat products – especially veggie burgers and plant-based meat analogues – a brief description of other meat alternatives is provided to obtain a general framework of this recent topic.

#### **Microalgae-based meat alternative**

Being recently discovered, the use of microalgae to manufacture meat substitute is still a research subject involving the food scientific community. Since algae are excellent source of proteins, their use could be exploited to produce vegan products, including meat analogues. Therefore, several researchers are trying to develop foods resembling meat with the use of this ingredient [44]. The environmental benefits deriving from its application are tangible: to obtain the same yield of crops, microalgae's production require a substantial lower amount of arable land [45,46].

#### **Fungi-based meat alternative**

Another alternative protein is fungi-based meat, such as Quorn™ products, which are obtained in the laboratory from the cultivation of fungal tissues, precisely the mycelium [47]. Due the fibrous texture, processed mycoproteins from specific fungi are employed for the production of meat substitutes [48]. However, their use is still limited due to a low digestibility [45]. Furthermore, it has been shown by several European researchers that microbial proteins deriving from fungi could lead to a reduction of deforestation, loss of biodiversity and greenhouse gas emissions [49].

#### **Insect-based meat alternative**

Insect-based meat is processed starting from insect cells. Edible insects may have beneficial effects both in terms of human health and environmental impact. They represent a good source of proteins and fatty acids, especially Omega-3, and they have shown to be rich in vitamin B12, calcium, zinc, magnesium, and iron [50–52]. Their high nutritional value could contribute in preventing major health diseases, including diabetes, cancer, and cardiovascular diseases [50]. Furthermore, it has been demonstrated that the production of edible insects requires to a lesser extent the consumption of water, land, and

feed. To perform a comparison, the production of 1 kg of cricket's proteins emits 1 g of CO<sub>2</sub>, while the production of 1 kg of beef proteins causes 2.850 g of CO<sub>2</sub> emissions [51].

### **Cell-based meat alternative**

Cell-based meat, also recognized as cultured, *in vitro*, or lab-grown meat, is obtained in the laboratory by cultivating stem cells originally derived from the muscles of live animals [10, 53]. Stem cells do not only proliferate, but also transform themselves in muscle and fat cells [53, 54]. Since cells are directly cultivated in the lab, the major benefit is to avoid the phases of raising and slaughtering animals [55]. Even though the environmental and health benefits deriving from the production of *in vitro* meat are still being assessed, from an animal welfare perspective there is almost no doubt on its advantages. Indeed, cultured meat does not require killing animals, and it is supposed to be pain-free [53].

## **2.2 Environmental benefits of plant-based alternatives**

### **2.2.1 Environmental impacts of meat production systems**

The growing global trend in meat consumption and production has severe negative impacts on the environment [56]. Energy, water, and land are natural and scarce resources that are increasingly needed to produce livestock [57, 58]. Indeed, livestock production represents a crucial point not only for the consumption of natural resources, but it has severe impacts on water, soil, and air quality, contributing to pollution, greenhouse gases emissions, loss of biodiversity, deforestation, land degradation and climatic change [8, 57, 59, 60]. Furthermore, not only the use of resources, but also acidification, eutrophication and global warming are partially caused by meat production. In particular, the raising of livestock carried out in farms is the leading cause for these negative impacts on environment when compared to slaughterhouse and meat processing steps according to the LCAs methodology [57].

Land is the basis for agricultural activities, including livestock grazing.

Land conversion to agriculture represents the primary cause of greenhouse gas emissions, while also contributing to biodiversity loss and land degradation. Therefore, its use needs to be strictly regulated to maximize land efficiency while minimizing its negative effects on environment [74]. The global land area for agriculture is 38% of the Planet's ice-free land [74], and to produce livestock the land required represents almost the 80% of the global agricultural land [62]. Moreover, nearly 68% of cereals are used in developed economies to nourish animals [63], and the 30-40% of human edible crops are used for livestock production [60]. The rising food to fuel competition – the calories from cereals that could be directly used for human consumption instead of animals – could have a negative impact on the global food security. Overall, the manufacture and transport of feed destined for livestock contributes to 45% of the greenhouse gas emissions [64, 65].

Livestock production contributes to the release of methane and nitrous oxide from manure, non-carbon dioxide related emissions, thus leading to an increase in greenhouse gas emissions [64, 66]. Nitrous oxide, nitrate and ammonia represent the most dangerous materials produced by manure, contributing to global warming, eutrophication, and acidification respectively [57]. However, different types of animals raised for livestock production contribute to distinct environmental impacts: beef has the highest energy requirement and therefore more resources are needed, leading to an increased ecological impact [12]. Furthermore, animals, especially ruminants, are inefficient converters of feed to meat: almost 75-90% of the energy used is either lost in manure or used to support their growth [57, 67].

According to FAO (2020) [68] the production of 1.9 billion livestock units (LSU) was estimated in 2018. The global production of manure from livestock accounted for 125 million tonnes N, within which 116 million tonnes N correspond to the manure deposited on agricultural lands. In 2018, the amount of manure N on agricultural lands that volatilized in the air as ammonia accounted for 23 million tons N, rising the negative phenomenon of air pollution. Similarly, also water pollution improved due to the loss of 35 million tons N in soil water. In 2018, globally speaking, the impact on the environment measured through the excess of N was equal to 58 million tonnes.

When considering climate change, in 2018, the contribution to GHG emis-

sions from the production of livestock manure was 1.4 billion tonnes of CO<sub>2</sub>eq, while the GHG emissions generated from the enteric fermentations accounted for 2.1 billion tonnes CO<sub>2</sub>. Among the livestock species, the greatest contributor to GHG was cattle, with 1.5 billion tonnes CO<sub>2</sub>. However, these results cannot be equally attributable to all regions. Indeed, the major presence of livestock population (LSU) was in Asia, America, and Africa while the average annual growth rates is higher for Africa, America, and Asia respectively. Only Europe and Oceania registered a negative trend of the livestock population growth in 2018. As for livestock manure deposited on agricultural lands, the main responsible are Asia, America, and Africa. Thanks to European regulations implemented at the end of the 1980s limiting the nitrogen pollution from agriculture, the amount of livestock manure decreased by 46% in Europe since 1990, reaching in 2018, 11 million tonnes N. Interestingly, when considering the GHG emissions related to livestock production, methane from enteric fermentation and the emissions of N<sub>2</sub>O from livestock manure left on pastures are the two leading causes of those emissions. However, in Europe the second cause of greenhouse gases emissions was not N<sub>2</sub>O from livestock manure left on pastures, but manure management.

According to FAO (2020) due to higher herd inventories (output to animal inventory ratios) and productivity in animal stocks, the meat sector emissions are expected to improve by 5% by 2030. However, thanks to innovative technologies in meat production and the increasing concerns of consumers towards environmental sustainability, further reductions of methane emissions per unit could be achieved.

### **2.2.2 Comparison of the environmental impact between meat and plant-based products**

In this respect, changes in dietary habits relying on the reduction in meat consumption in favour of plant-based products is a possible solution to lessen the environmental impact deriving from livestock production [58]. Indeed, numerous studies show that products of animal origin have a higher carbon and water footprint compared to plant-based products [64]. Hence, it is possible to affirm that dietary habits influence greenhouse gases emissions [69]. However,

the contribution to GHG emissions differs among foods. According to the study of Tilman & Clark (2014), reviewing the lifecycle GHG emissions (CO<sub>2</sub>-Ceq) for different food products, for a total of 555 LCA analysis, plant-based foods contribute to a lower GHG emissions compared to animal-based products. Based on their analysis, the most remarkable difference regards ruminant meats when compared to legumes: beef and lamb productions cause emissions per grams of proteins 250 times higher than legumes [69]. Several environmental impact categories of a product are assessed and quantified in a standardize way by the lifecycle assessment (LCA) methodology [70–72], as in the just mentioned study of Tilman & Clark (2004). This method is defined by the European Commission as “an internationally standardised methodology (ISO 14040 ff). LCA helps to quantify the environmental pressures related to goods and services (products), the environmental benefits, the trade-offs and areas for achieving improvements taking into account the full life-cycle of the product.” [73].

Another research paper reviewing 52 life cycle assessment studies (LCAs) of animal and vegetable products as source of protein has been conducted by Nijdam et al. (2012) [72]. In their analysis, the focus was on land use (m<sup>2</sup> y kg<sup>-1</sup>), including arable land and grassland, and carbon footprint (kg CO<sub>2</sub>-eq kg<sup>-1</sup>), quantifying GHG emissions. In line with the previous review, results show that ruminant meat, especially beef, is the major contributor to environmental impact, both considering carbon footprint and land use per kilogram of edible product. This is explained by the fact that in ruminants, methane is produced by enteric fermentation, an anaerobic process, in the digestive tract or in the rumen. Hence, enteric methane is expelled by ruminants through burping, and this phenomenon contributes to strengthening global warming [74,75]. According to FAO (2022), the production of enteric methane is directly attributable to the “level of intake, the type and quality of feed, the amount of energy consumed, animal size, growth rate, level of production, and environmental temperature” [74]. Another element contributing to environmental impact is the extensive farming system used to produce ruminant meat, occupying a large share of land, especially grasslands, that are less productive than arable lands [72].

A great difference is noticeable when comparing ruminant meats, lamb and

beef, with meat substitutes and pulses. Indeed, vegetarian products scored the lowest in terms of carbon footprint and land use. Similar results are appreciable when considering the environmental pressure per kilogram protein: vegetable meat substitutes have a carbon footprint 150 smaller than ruminant meats. Even a greater difference is noticeable when comparing land use, which ranges between  $10\text{m}^2 \text{ y kg}^{-1}$  protein for vegan meat alternatives to  $2000\text{m}^2 \text{ y kg}^{-1}$  protein for ruminant meat from extensive pastoral systems [72].

Another methodology, the dietary scenario analysis, could be employed to quantify the effects of different dietary patterns on several aspects and dimensions of sustainability. According to the study of Hallström et al. (2015) [70], vegan diet can potentially reduce by 25% to 55% the greenhouse gas emissions, while the vegetarian by 20% to 35%. In general, the potential reduction of the total per capita GHG emissions ranges between 4-20% by following a vegan diet and 12% by sticking to a vegetarian diet. However, these results consider the avoidance of ruminant meats, which have the greatest impact on climate. Actually, it has been estimated that a reduction of GHG emissions is still possible by substituting beef and lamb with monogastric meat (i.e., poultry) or by following a diet with a reduced consumption of red meat. Significant results also apply to the land use demand, which could be decreased by 50 to 60% and 30 to 50% for vegan and vegetarian diets respectively. Therefore, more sustainable options for consumers are needed to partially substitute meat products.

### **2.2.3 Analysis of the environmental impact for Beyond Meat® Inc. and Impossible™ Foods Inc.**

When focusing on plant-based meat alternatives, two major companies should be considered for the discussion of the environmental impacts of their products: Beyond Meat® Inc. and Impossible™ Foods Inc.. As regards ingredient composition, Beyond Burger® is principally made from a mixture of pea protein, vegetable oils, including canola and coconut oil, and other minor ingredients along with flavour components, apple extract and beet juice used to mimic the appearance and taste of conventional meat [76]. Impossible™ Burgers are constituted by soy and potato proteins, vegetable fats as coconut and sun-

flower oil, and binders; this brand uses heme protein to mimic the flavour of meat [77, 78]. Both Beyond Meat® Inc. and Impossible™ Foods Inc. provided an analysis comparing the environmental LCAs of their Burger with a conventional ground-beef burger.

The peer-reviewed LCA analysis of the Beyond Burger's environmental footprint was carried out in 2017 (Table 2.1) [79]. The functional unit used for the comparison between Beyond Burger and U.S beef burger was 4 oz. (0.113 kg) of uncooked burger patty delivered to retail outlets. The selected impact categories allowing the comparison were: GHG emissions, energy use, water use impact and land use impact. According to the analysis, the production and delivery of ingredients is the most impactful in terms of GHG emissions, energy use and land use, while the processing stage is the main responsible for the characterized water use. When compared with the U.S beef burger, it has been established that the production, packaging, and distribution of Beyond Burger requires:

- 90% fewer GHG emissions
- 43% less energy
- 99.5% less water (characterized)
- 93% less land use (characterized)

Impact category	Unit	Beyond Burger	Beef patty	Difference %
GHG emissions	kg CO <sub>2</sub> eq.	0.4	3.7	-90%
Energy use	MJ	6.1	11.4	-43%
Characterized land use	m <sup>2</sup> a eq.	0.3	3.8	-93%
Characterized water use	liter eq.	1.1	218.8	-99.5%

**Table 2.1:** Comparison of total cradle-to-distribution impacts of quarter pound Beyond Burger and quarter pound U.S. beef burger.

**Source:** Personal elaboration of data gathered by Heller and Keoleian, 2018. Beyond meat's beyond burger life cycle assessment: a detailed comparison between a plant-based and an animal-based protein source, Report No. CSS18-10. Ann Arbor.

After conducting the analysis, Beyond Meat includes the possibility to improve their packaging sustainability by switching from polypropylene tray to polypropylene tray with increased postconsumer recycled content. Thereby, total GHG emissions could be further reduced of 2% and the energy use by 10% [79].

Similar findings (Table 2.2) emerged from the LCA analysis of Impossible Burger® 2.0, carried out in 2019 [80]. According to the impact categories taken into consideration, compared to an industrial beef burger produced in the U.S, this plant-based alternative has the following results:

- It consumes 87% less water since irrigations to produce feed for animals are avoided.
- A reduction in land use of 96% resulting from not raising animals and not producing feeding stuff.
- Global warming potential is reduced by 89% as the production of manure and enteric emissions, which have a great impact in terms of GHG emissions, deriving from the raising of beef cattle are completely avoided.
- A reduction of the aquatic eutrophication potential by 92% is obtained since manure is not produced, and therefore emissions in aquatic environments are avoided; moreover, the negative effects of fertilizers used for the production of feed are prevented, together with the reduction of electricity used in the slaughterhouses.

Impact category	Unit	Impossible burger	Beef burger	Difference %
Aquatic eutrophication potential	G PO <sub>4</sub> -eq	1.3 (2.3-9.7)	15.1 (14.3-60.6)	-92%
Global warming potential	Kg co <sub>2</sub> -eq	3.5 (3.1-4.0)	30.6 (25.3-37.5)	-89%
Land occupation*	M <sup>2</sup> .y	2.5 (1.6-3.7)	62.0 (37.0-102.5)	-96%
Water consumption	L	106.8 (56.9-203.3)	850.1 (617.9-1238.1)	-99.5%

**Table 2.2:** Baseline results for a kg of Impossible Burger® and beef burger (IMPACT 2002+ v2.28). Italic number in parenthesis represent 95% confidence intervals.

\*Land occupation is reported at an LCI level.

**Source:** S. Khan et al., 2019. Comparative environmental LCA of the impossible burger with conventional ground beef burger.

In conclusion, it is possible to affirm that most types of meat, especially ruminant, have a higher environmental impact in comparison to plant-based foods and plant-based meat substitutes. Indeed, the production of meat alternatives requires a significant lower amount of natural resources (water, land), together with a reduced emissions of GHG. Hence, these eco-friendlier options should not be only implemented in the diet of vegan and vegetarian people, but also by those following an omnivorous diet.

## 2.3 Health benefits of plant-based alternatives

### 2.3.1 Meat: nutritional composition and health-related concerns

Meat is a primary source of high-quality nutrition [81]. In human diets, it provides valuable proteins [82–84]: this macronutrient is found in every body cell, and it is involved in almost all body's functions and life processes (M. Marangon, personal communication, 2021). By providing energy, proteins sustain the optimal growth and development of tissues, essential to maintain

body's structure [85]. The content of protein of raw red muscle meat stands at 20-25 g/100 g, while its content increases up to 28-36 g/100 g in cooked red meat, since part of the water contained is lost during cooking, favouring the concentration of nutrients [86,87]. Meat and meat products – dairies and eggs – are complete source of high-quality proteins as they contain all essential amino acids (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophane, and valine) which cannot be synthesised by the body and so must be assumed through the diet (S. Maggi, personal communication, 2021) [83, 85, 88–90]. The quality of proteins is also measured by their digestibility, and animal proteins are 90-99% absorbed (M. Marangon, personal communication, 2021). For instance, Protein Digestibility Corrected Amino Acid Score (PDCAAS) is a method often used to evaluate the quality of proteins in human nutrition, and it has been adopted by FDA and FAO/WHO as the preferred approach [89,91]. It is calculated by comparing the content of the limiting essential amino acid of the test protein as a percentage of the content of the same amino acid of a reference protein. The reference is calculated on the optimal amino acid intake of children of 2-5 years. After, the percentage is corrected for the true fecal digestibility of the reference protein [91]. Given the maximum score of PDCAAS of 1.0 indicating the highest protein quality, beef and other meats have a score of 0.9, which is particularly high when compared to most vegetables and legumes scoring 0.6-0.7 [87]. However, soy protein, which is frequently used for the preparation of plant-based meat substitutes, scores 1 [92]. Red meat is a considerable source of fat, ranging between 3-7% (A. Cecchinato, personal communication, 2021). Fatty acids composition varies according to several factors, including breed, sex, age, rearing system, feeding system, and cut of meat. Lipids found in red meat are SFAs (saturated fatty acids), MUFAs (monounsaturated fatty acids) and PUFAs (polyunsaturated fatty acids) in different concentrations. For instance, bovine meat is characterised by having 46.5, 48.9, and 4.59 g per 100 g of total fatty acids for SFAs, MUFAs, and PUFAs, respectively [93, 94]. Low levels of trans-fatty acids are naturally found in ruminant meat, occurring from the process of biohydrogenation carried out by rumen bacteria [87,95]. As for almost all animal foods, red meat represents a valuable source of micronutrients. It provides excellent amount of bioavailable vitamin B12, B6, thiamine,

niacin, but also minerals including iron, selenium, and zinc [81,82,85,87,88,93].

However, high intake of meat, especially processed meat, has been linked by several studies with an increased risk of major health diseases, including diabetes, obesity, stroke, coronary heart diseases, colorectal cancer, and other chronic burdens, which could lead to death [96]. In 2015, red meat and processed meat were evaluated by the International Agency for Research on Cancer (IARC) Monographs Programme, as a consequence to the increasing concerns highlighted by several epidemiological studies indicating that a slight increase in the risk of cancer may be linked to the consumption of such foods [97]. Red meat is defined by the World Health Organization as “fresh unprocessed mammalian muscle meat (e.g. beef, veal, pork, lamb, mutton, horse, or goat meat), which may be minced or frozen, and is usually consumed cooked”, while processed meat as “meat that has been transformed through salting, curing, fermentation, smoking, or other processes to enhance flavour or improve preservation. Most processed meats contain pork or beef, but processed meats may also contain other red meats, poultry, offal, or meat by-products such as blood” [93]. As a result of the analysis, in 2015, WHO’s IARC classified red meat as probable carcinogen (Group 2A), with evidence for colorectal, pancreas, and prostate cancer, while processed meat as carcinogenic to humans (Group 1), based on evidence of colorectal cancer [93,97,98]. According to this classification, a limited evidence (Group 2A) is found in humans for the carcinogenicity deriving from the consumption of red meat, whereas there is sufficient evidence (Group 1) in humans for the carcinogenicity from the consumption of processed meat [93]. Indeed, in processed meat, the curing phase, such as the addition of nitrate and nitrite, and the practice of smoking, could generate NOCs, including N-nitrosamines and PAHs [93]. Furthermore, the presence of high level of salt increases blood pressure, which could cause hypertension and heart diseases (S. Maggi, personal communication, 2021). As for red meat, the high content of heme iron could improve the risk for the development of several cancers [98]. Even though IARC Working Group did not find enough data establishing a significant correlation between cooking method and risk of cancer, it has been confirmed by several studies that peculiar preparations could lead to the production of potential carcino-

gens. Indeed, pan-frying, grilling, and barbecuing are practices that directly expose the surface of meat to high temperatures, thus generating carcinogenic compounds, including PAHs (Polycyclic Aromatic Hydrocarbons) and HAAs (Heterocyclic aromatic amines) [93,97].

Meat is linked to various health advantages and disadvantages. Therefore, according to several dietary guidelines, its consumption should not be completely avoided. Indeed, dietary guidelines from WHO “Healthy Diet”, CREA “Linee guida per un’asana alimentazione” and the Unesco’s Mediterranean diet, recommend a portion of 100 grams of red meat 1-2 times per week, and less than one time per week for processed meat. Moreover, lean red meat should be preferred to reduce the intake of saturated fatty acids and cholesterol [95]. As for white meat, mainly poultry, the recommended portion is 100 grams 1-3 times per week [99–102].

### **2.3.2 Plant-based alternatives: ingredients composition of veggie burgers and meat analogues**

A reduction in meat consumption in favour of plant-based foods – vegetables, fruits, legumes, cereals – has been addressed by numerous dietary guidelines. It has been encouraged a shift from the Western diet, rich in saturated fatty acids, salts, sweets, red meat, and processed meat, to a semi-vegetarian or “flexitarian” diet, based on the limited consumption of animal products in favour of plant-based alternatives [103]. These changes in dietary habits have led to the introduction in the market of alternative plant-based foods, as veggie burgers and subsequently novel generation of plant-based meat alternatives mimicking meat.

Veggie burgers and novel generation PBMA could differ between brands in terms of ingredients formulations. Commonly, soy proteins are the preferred alternative to animal-derived proteins because of their large availability, due to low cost, and their functional properties which particularly suite these preparations [12,103]. Soy proteins could be employed in different forms, including soy flour, soy protein concentrate, and isolated soy protein. Furthermore, soy’s nutritional properties and high biological value enhance its applications [31].

Especially for the production of meat analogues, TVP are commonly used to reach a similar texture to meat [42]. Legumes, including peas, lentils, and chickpeas represent an economic source of proteins, valuable in terms of human nutrition and functional properties [31, 36, 103]. Cereals proteins, especially wheat gluten, are largely employed in different forms, such as seeds, flours, or flakes [31, 36]. Recently, pseudo-cereals have been introduced in the ingredients list of several veggie burgers due to their nutritional properties and lack of allergenicity typical of soybeans [103]. For instance, Valsoia® commercialises a vegan patty made of spinach and quinoa [104].

By looking at the ingredients list of several veggie burgers, it is possible to appreciate the presence of vegetable oils, especially sunflower seed oil to replace animal fat [104, 105]. However, to produce meat replacers, other sources of lipids are used, including canola oil and coconut oil. Indeed, combinations between liquid fats – canola, sunflower oil – and solid fats – coconut oil – are used to reach a pleasant mouthfeel resembling meat [42]. In Table 2.3 and Table 2.4 the ingredients lists of two veggie burgers and two meat analogues are shown.

As for veggie burgers, the taste differs according to the combinations of vegetables: carrots, zucchini, peppers, spinach, eggplants, mushrooms, pumpkin, are among the preferred ingredients. To further enhance the flavour, onion, garlic, together with different aromas and spices are added [104, 105]. However, when considering meat analogues, the flavouring process is particularly complex. During processing, physiochemical changes may occur, leading to the creation of peculiar volatile aroma components. To further mimic the taste of meat, other ingredients are often added, such as reducing sugars, amino acids, thiamine, and nucleotides [13]. Several stabilizers are often employed for manufacturing both veggie burgers and meat analogues. Xanthan gum, carob seed flour, methylcellulose, carrageen, gum Arabic, cellulose from bamboo are examples of stabilising agents used for the preparation of plant-based burgers [76, 77, 104].

Among preservatives, salt is the most used to prologue the shelf-life of plant-based burgers, but also potassium sorbate, ascorbic acid, and citric acid are commonly employed [13, 106].

For the production of meat analogues, peculiar ingredients are utilized to

Company	Type of plant-based	Burger	Ingredients list
Kioene	Veggie Burger	Mini Vegetable burger with spinach	Spinach 25%, carrots 24%, SOY flour restructured and rehydrated, sunflower seed oil, WHEAT gluten, starches, breadcrumbs (soft WHEAT flour type "0", brewer's yeast, salt), potato flakes, rice flour, SOY protein isolate, onion, pea fiber, salt, sugar, preservative: potassium sorbate; dehydrated garlic, spices.
Valsoia	Veggie Burger	Burger with spinach, Gustosino® and quinoa	Restored soya flour (18%), spinach (12%), carrots, potatoes, onion, quinoa seeds (3%), sunflower oil, citrus fiber (2.5%), soy based food preparation (1%)(soya extract 62% (water, soybeans (8.2%), modified starch, sunflower oil, sea salt, stabilizers: xanthan gum - locust bean flour, acidity regulator: lactic acid, flavors), sea salt, sugar, natural flavor (with soy and celery), stabilizer: methyl cellulose, soy protein (0.06%), vitamin B12.

**Table 2.3:** List of ingredients of two veggie burgers produced by Kioene and Valsoia.  
**Source:** Valsoia - Bontà e Salute, <https://www.valsoia.it/prodotti/pietanze-vegetali/burger-agli-spinaci-gustosino-e-quinoa/>  
Kioene, <https://www.kioene.com/it/prodotti/mini-burger-vegetale-agli-spinaci/>

Company	Type of plant-based	Burger	Ingredients list
<b>Beyond Meat</b>	Meat analogue	The Beyond Burger	Pea protein isolate, expeller-pressed canola oil, refined coconut oil, rice protein, natural flavors, dried yeast, cocoa butter, methylcellulose, and less than 1% of potato starch, salt, potassium chloride, beet juice color, apple extract, pomegranate concentrate, sunflower lecithin, vinegar, lemon juice concentrate, vitamins and minerals (zinc sulfate, niacinamide [vitamin B3], pyridoxine hydrochloride [vitamin B6], cyanocobalamin [vitamin B12], calcium pantothenate).
<b>Impossible Foods</b>	Meat analogue	Impossible Burger	Soy Protein Concentrate, Coconut Oil, Sunflower Oil, Natural Flavors, 2% Or Less Of: Potato Protein, Methylcellulose, Yeast Extract, Cultured Dextrose, Food Starch Modified, Soy Leghemoglobin, Salt, Mixed Tocopherols (Antioxidant), Soy Protein Isolate, Vitamins and Minerals (Zinc Gluconate, Thiamine Hydrochloride (Vitamin B1), Niacin, Pyridoxine Hydrochloride (Vitamin B6), Riboflavin (Vitamin B2), Vitamin B12.

**Table 2.4:** List of ingredients of two meat analogues burgers produced by Beyond Meat and Impossible Foods.

**Source:** Beyond Meat, <https://www.beyondmeat.com/en-US/products/the-beyond-burger>

Impossible Foods, <https://faq.impossiblefoods.com/hc/en-us/articles/360018937494-What-are-the-ingredients-in-Impossible-Burger->

replicate the juiciness of meat. The “bleeding” is often obtained by using beetroot juice [31]. Furthermore, colouring agents are added as additives to mimic the colour of meat, including beetroot, betaine, carotene, caramel colours and so forth [13].

Due to the increasing attention to health-related topics, several brands enrich their products by adding bioactive components, including probiotics, antioxidant, and fibers [103]. Furthermore, since plant-based products lack in vitamin B12, which is commonly found in animal-based foods, few vegetable burgers are fortified with this micronutrient [107].

### **2.3.3 Health benefits and limitations of plant-based alternatives: a comparison between the nutritional value of meat, veggie burgers, and meat analogues**

Table 2.5 illustrates the comparison of the nutritional facts of novel generation plant-based meat burgers with their meat counterparts according to the study carried out in Italy by Cutroneo et al. (2021) [108]. Plant-based burgers have a higher energy content than meat. A greater carbohydrates content is considerable in plant-based burgers, together with dietary fibre, which naturally lacks in the animal-based homonymous [108, 109]. Dietary fibers are beneficial for human health, resulting in a reduced risk of constipation, diverticulosis, heart diseases, obesity, diabetes Mellitus, and cancer (S. Maggi, personal communication, 2021). Especially in Western diet, the intake of dietary fibre should be improved, and plant-based alternatives could be useful to reach this goal [109]. However, when discussing the nutritional benefits of plant-based burgers, the addition of carbohydrates, including sugars, should be taken into consideration. As shown in Table 2.5, meat analogues often present increased amounts of total sugars, thus limiting the advantages of this product [12]. The fat content of meat analogues could vary between brands according to ingredients formulations. The study carried out by Cutroneo et al. (2022) [108], highlights the slightly lower content of lipids of plant-based burger respect to the conventional counterpart, although no differences were found by the study conducted by De Marchi et al., (2021) [109]. However, the latter paper evidences a great difference in cholesterol content. Indeed,

Category	Energy kcal/100g	Total fat g/100g	Saturates g/100g	Total carbohydrates g/100g	Sugars g/100g	Fibre g/100g	Protein g/100g	Salt g/100g
<b>Meat analogue burgers</b>	209 (176-233)	10.6 (7.0-13.0)	1.3 (1.0-1.9)	14.0 (10.7-17.8)	2.0 (1.0-3.1)	4.7 (3.9-6.5)	12.0 (6.8-15.0)	1.2 (0.9-1.5)
<b>Meat burgers</b>	180 (147-223)	11.0 (7.4-16.0)	4.5 (2.6-6.6)	1.4 (0.5-3.1)	0.3 (0.0-0.5)	0.0 (0.0-0.5)	17.0 (16.0-18.2)	1.2 (1.0-1.4)

**Table 2.5:** Comparison between the nutritional declaration of plant-based burgers resembling meat and conventional meat burgers. Data are expressed as median (25°–75° percentile) obtained from 105 plant-based burgers and 103 meat burgers.

**Source:** Personal elaboration of data gathered by Cutroneo et al., 2022 - Nutritional Quality of Meat Analogues: Results From the Food Labelling of Italian Products (FLIP) Project

meat analogues show much lower level of cholesterol when compared to beef burgers [27, 109]. Even though similar concentrations of saturated fatty acids have been detected in both burgers, the amount of polyunsaturated fats, especially n-6 fatty acids, is higher in plant-based alternatives [109]. Slightly different results have been obtained [108], observing a lower amount of saturated fatty acids in plant-based burgers. As already mentioned, a diet rich in cholesterol and saturated fatty acids could improve the risk of cardiovascular diseases, stroke, and cancer [110]. Therefore, a limited consumption of high-fat red meats in favour of leaner cuts and plant-based alternatives should be preferred.

According to De Marchi et al. (2021) [109], the protein content of plant-based burgers does not differ from the meat counterpart, although different results showing reduced quantities of proteins in meat analogues were reported [108]. Interestingly, significant differences have emerged in the content of five amino acids out of the eighteen that have been identified in plant-based burgers [109]. In particular, lower level of alanine, glycine, and methionine (essential amino acid) characterise the plant-based sample, while higher level of cysteine (essential amino acid) and glutamic acid could be appreciated. It should be noted that the amino acids profile of plant-based alternatives differs according to the plant used as source of proteins. Indeed, soy and pea proteins meet the requirements for essential amino acids established by WHO/FAO/UNU, while lupin and oat proteins do not reach the expected amount [111].

Although limiting the consumption of red meat and processed meat in favours of plant-based alternatives could be beneficial to health, several stud-

ies highlighted the deficiency of peculiar micronutrients. Vitamin B12, also known as cobalamin, is only found in products of animal origin, including meats, dairies, eggs, fish, and shellfish. Deficiency in Vitamin B12 may cause several symptoms which differ according to the severity of the problem; severe deficiency could lead to anaemia and nervous system disorders [107]. Since plant-based products naturally lack in vitamin B12, deficiencies are more common in strict vegans (S. Maggi, personal communication, 2021). Therefore, some brands fortify their products by adding synthetic cobalamin [107]. However, according to the data gathered through the analysis of 137 plant-based products found in the shelves of supermarkets in Sydney, only 24% of meat alternatives are fortified with vitamin B12 [112].

Similarly, it has been demonstrated that meat analogues do not apport adequate amount of zinc [109, 112]. This mineral is an essential trace element [113], and it is required for several biochemical functions of the body. Deficiencies in zinc may negatively affect various organ systems, including the epidermal, gastrointestinal, central nervous, immune, skeletal, and reproductive systems [114]. According to the study conducted in Sydney, only 18% of plant-based products are fortified with this mineral [112]. Therefore, fortifications of vitamin B12 and zinc should be implemented to overcome possible deficiencies deriving from the strict consumption of plant-based foods.

Since the thesis aims at analysing both veggie burgers and plant-based meat analogues, a comprehensive comparison with conventional meat is assessed by taking into consideration the results of the author Cole et al. (2021) [27]. The findings are relative to the sample of 41 beef burgers, 89 veggie burgers, and 28 imitation burgers available in the United States. Data are reported according to a standardised analysis, meaning that nutrients are standardised based on 100 g for all three categories of products.

In terms of caloric content, veggie burgers score lower compared to imitation and beef burgers. The conventional one has the highest calories per 100 grams. The same results are obtained for total fat, saturated fatty acids, trans-fat, and cholesterol, which are greater in beef burgers, especially when compared to veggie patties. The protein content of meat analogues and beef burgers do not differ, contrary to veggie burgers showing a reduced amount

of this macronutrient. As for carbohydrates, veggie burgers score higher, followed by meat analogues and beef burgers. The fibre content of imitation and veggie burgers do not differ, showing a significantly higher content compared to conventional burgers. No differences in total sugars content are found when comparing meat analogues and beef burgers, while veggie burgers have significantly higher amounts. Vegetarian alternatives and meat replacers show similar amount of total sodium content, which is especially higher when compared to conventional meat burgers. Regarding micronutrients, veggie burgers score higher for vitamin A and C content, while imitation burger for vitamin D. Interestingly, the quantity of iron, calcium, and potassium contained in imitation burgers is higher compared to beef and veggie burgers, and these results are in line with other studies [109]. However, the bioavailability and bioaccessibility of those minerals should be furthered analysed since they could differ among animal-based and plant-based foods.

In conclusion, the consumption of plant-based products could apport beneficial implications to human health due to the lower amount of saturated fats, trans fatty acids, and cholesterol and higher quantity of dietary fibers and several micronutrients, which are proven to be favourable for health. Nevertheless, the greater quantity of sugars and salts, and lower amounts of zinc, vitamin B12, and proteins could deter the purchase of these products.

### 2.3.4 Health-related recommendations

Plant-based foods, including veggie burgers and the modern meat analogues are becoming mainstream products. However, precise information regarding their nutritional composition is lacking. For instance, several plant-based alternatives are categorised as “ultra-processed” foods (UPFs). According to NOVA food classification system, UPFs are those products deriving from several industrial processes aiming at transforming whole foods into formulations of substances, such as protein isolates, fats, sugars. These are often added with colours, flavours, and emulsifier to improve their palatability and prolong the shelf-life. Furthermore, increased amounts of sugars, saturated fats, and sodium are often found in these foods [115,116]. It should be clarified that not every plant-based product can be classified as UPFs. Although several dietary guidelines [99,100] discourage an excessive consumption of processed products

in favour of whole foods, there is still poor knowledge regarding the consumption of vegetarian and vegan UPFs [115]. Furthermore, as previously pointed out, a shift towards diets restricting the consumption of red meat and processed meat in favour of plant-based foods has been recommended. Therefore, clear, and coherent information evidence-based regarding the consumption of plant-based substitutes should be delivered to consumers by dietary guidelines and food policies.

The data reported in Table 2.5 show a wide spectrum of values, meaning that although they are products of the same category, they can significantly vary at nutritional level. Furthermore, a percentage of plant-based alternatives is also fortified. This may cause confusion in consumers. Consequently, a standardized index could be implemented in vegetarian and vegan alternatives to make the composition of the product easy to understand for the average consumer.

## **2.4 Animal welfare benefits of plant-based alternatives to meat**

Meat industry rises several concerns related to animal welfare [12, 117]. This topic has become gradually more important in several countries and the European Union [117]. Due to numerous factors allowing a greater and simpler exchange of information, consumers have become more curious regarding the production of meat, questioning how animals are reared, transported, and slaughtered [117, 118]. Therefore, various legislations have been created to assure that animal needs are met, and the presence of animal welfare organisations further strengthens the support to animals [12]. However, neglect of animals and abusive treatments are still a major problem in several farms. Since most of these issues happen especially in conditions of poor management supervision of workers, improving the management by better controlling employees is needed to avoid these phenomena [118]. Furthermore, animals should not be exposed to stress conditions since they could provoke negative changes in their performance [119].

Several consumers are becoming increasingly concerned regarding animal welfare related issues. Indeed, animal welfare represents one of the reasons

justifying the changes in dietary habits towards vegetarian and vegan diets which is occurring in many Western countries [10,12,120,121]. Certainly, plant-based alternatives do not include the slaughter of animals, and usually they do not have direct negative impacts on animal welfare. However, vegetarian plant-based products including dairy-based and egg-based additives could rise some ethical concerns regarding the production system of eggs and dairies.

Even vegan alternatives could negatively affect animal welfare, since the production of monocultural crop cultivations has an impact on biodiversity, hence contributing to the destruction of natural habitats [10].

## **2.5 Drivers and barriers towards the consumption of plant-based foods**

The rising concerns, together with a greater awareness of several consumers regarding health, environmental sustainability, and animal-welfare have contributed to the development of plant-based food products [122]. Even though consumers display greater interest towards plant-based foods [121], the market share of these substitutes is still low [123]. According to FAO, meat analogues represented only 1% of the total meat sales in 2020. This trend is growing, but it is considerably lower than meat [6]. Therefore, it appeared useful to analyse the drivers and barriers facilitating and limiting the consumption of plant-based foods, focusing especially on veggie burgers and meat analogues. For this purpose, extensive literature review has been evaluated to obtain a comprehensive understanding relatively to the subject of the thesis.

Before reaching to the core of the analysis, it should be stated that consumers choices are complex. Interactions between several factors strongly influence consumers buying decisions [121]. For instance, taste, price, and convenience play a key role shaping consumer behaviour, but also social-context, culture, attitudes, beliefs, familiarity, environmental and health concerns influence what we eat [41,121,123]. Dietary habits of consumers play a fundamental role defining the perception about plant-based products. Indeed, vegetarians and vegans are expected to have a more favourable perception than omnivores. Besides, consumers expectations relatively to vegetarian and vegan alternatives could be further influenced by age, gender, and education level [124]. Studies

show that Millennials are more aware of environmental and health issues [125].

### **2.5.1 Drivers towards the consumption of plant-based foods**

Changes in dietary habits towards an increased consumption of plant-based foods could be attributed to several factors [121]. Existent literature largely agrees on the importance of environmental sustainability, health and wellness, and animal welfare concerns as important reasons motivating the consumption of plant-based foods [14, 121, 122, 124–135]. The degree of personal involvement differs among people and could act as a facilitator for the purchase of meat alternatives. For instance, high involvement related to animal welfare is more common among vegetarians and vegans, justifying their eating behaviour [14]. Plant-based diets are often recognized healthier alternatives to meat. Actually, a large share of consumers expects a reduction in body weight by limiting the consumption of animal-based products in favour of vegetarian products [131]. Therefore, the importance attributed to environmental impact, health, and animal welfare could positively influence the perception of consumers regarding meat alternatives [136].

Traditional motivations influencing food choices involve hedonic attributes, including taste, texture, smell, and appearance [41]. Usually, these attributes are particularly appreciated by those consumers with a low intake of animal foods [122]. Indeed, the dislike for meat taste is reported to be a driver for the consumption of plant-based products. This statement holds true for traditional veggie products, since they do not resemble the taste of meat, but it could act as a barrier when considering the modern imitation meats [131, 137]. Food curiosity may stimulate consumers to purchase new foods, acting as a facilitator towards the adoption of plant-based meat alternatives [132].

Meat analogues and veggie burgers are often perceived easy to cook, especially by those consumers already eating them. Therefore, the perceived ease of preparation represents a driver for their consumptions [122]. Another factor facilitating their purchase is the convenience, intended as the product availability, which is mostly perceived by younger generations. Tradition and familiarity could represent a driver for the consumption of plant-based food to

a certain extent. For instance, vegetarians, vegans, and flexitarians perceive eating those products as a regular practice. Consequently, these consumers are more likely to perceive plant-based alternatives familiar and traditional, but this does not commonly apply to omnivorous [41].

### **2.5.2 Barriers against the consumption of plant-based foods**

Individuals may display different attitudes and beliefs explaining the variations in the acceptance of plant-based meat alternatives [123]. For instance, non-users of meat analogues reveal a positive attitude toward meat, which is described healthier, more convenient, tastier, and more satiating than plant-based alternatives [129]. In addition, the beliefs that one's diet is healthy is a barrier limiting changes in dietary habits [131, 138]. Taste has been identified by several studies as a major barrier to the consumption of meat analogues [122, 123, 139] since many consumers are prejudiced about the sensory appeal especially when compared to meat [129]. Similarly, plant-based alternatives are often associated to disgust [140]. Food neophobia – fear of eating novel food – could actually limit the consumption of plant-based meat alternatives, even if this barrier is especially perceived for other meat alternatives, such as insects and algae [123, 125, 129, 132, 141, 142].

The perceived unavailability and lack of variety of plant-based products is a barrier for their consumption, especially when eating out [122, 124, 131, 143]. Often, meat alternatives are considered more expensive respect to meat, and this further restrict their consumption [124]. Lack of information plays a significant role limiting the purchase of meat analogues. Indeed, especially heavy meat-consumers are unaware of their positive health, environmental, and ethical benefits [121, 122, 131]. Besides unawareness, lack of interest and concern about certain issues is a reason limiting the consumption of plant-based foods [124].

Unfamiliarity is a major contributor limiting meat analogues consumption [123, 129]. The comparison with meat strengthens this statement since meat is a traditional and familiar food typical of Western countries [121, 129]. Hence, the perseverance of culinary habits and preferences for traditional meals are

barriers towards plant-based products [124].

The lack of cooking skills is another factor limiting the consumption of plant-based foods, as several people consider these products difficult to cook. Regarding health-related aspect, vegetarian meat alternatives are sometimes perceived not enough satiating and without sufficient amount of proteins [122]. Furthermore, plant-based products are often criticised for being too processed due to the presence of additives; this holds true especially when considering meat analogues that try to mimic the sensorial attributes of conventional meat [124].

## 2.6 Value action gap

For the purpose of this research, it could be useful to mention the concept of ‘value action gap’. It has been defined by Sustainable Development Commission (2006: 63) as “the observed disparity between people’s reported concerns about key environmental, social, economic or ethical concerns and the lifestyle or purchasing decisions that they make in practice” [144]. Especially when considering environmental sustainability, a disparity between the attitudes of people and their actions is often perceived. Indeed, consumers display a strong awareness and interest towards certain issues, often expressing solid support for the environment. However, they are not willing to change their behaviour and so to translate their beliefs into tangible actions [145].

The discrepancy between expressed opinions and behaviour is noticeable in few interviews carried out during the research. The probable origin of this gap could be the presence of biases often observed in the qualitative interviews. The method chosen for this research – in-depth interviews – allows the interviewer to obtain insightful answers from participants, and to deeply analyse their behaviour by asking follow-up questions. However, possibility of social desirability bias is contemplated, leading to a greater complexity in the analysis and interpretation of results.

Social desirability bias is the tendency of respondents to modify their answers to match what is perceived to be socially acceptable. Therefore, their actual answers differ from those exposed to the interviewer [146]. This bias often occurs because people want to avoid being negatively judged by others.

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Furthermore, by giving a ‘socially-acceptable’ answer, they project an image of themselves that is more positive [147]. To overcome this possible discrepancy during the interviews, it seemed useful to include within the in-depth interviews the ‘picture-sorting’ technique. As will be discussed in the following chapter (Chapter 3), this method allows to analyse the implicit associations of consumers regarding plant-based foods, thus obtaining more truthful answers. Indeed, it could allow to overcome the social desirability bias.



# Chapter 3

## Research Methodology

### 3.1 Introduction

In the following chapter, the research methodology will be described and analysed. The main differences between the qualitative and quantitative methodologies will be highlighted, and the reason why the first technique was chosen as the research approach for the thesis will be further explained. Specifically, in-depth interviews as data collective method represents an appropriate approach to obtain insightful answers from the respondents. A greater focus on the sampling selection, interview guide and how the interviews were conducted is given. Lastly, the two methodologies used for the purpose of this thesis will be exposed, namely the ladder interviews and picture-sorting techniques.

### 3.2 Research Approach

#### 3.2.1 Qualitative and Quantitative methods

To collect novel and useful information regarding consumers behaviours toward plant-based products, a field research was carried out. Because the data is directly gathered by the interviewer with the purpose to answer a direct need for information, this method is sometimes called primary data research. Qualitative and quantitative approaches are examples of primary data research. They consist in gathering, analysing, and reporting data in form of words or text in the case of the qualitative method, and in form of numbers for the quantitative

one (D. Rigoni, personal communication, 2021).

The qualitative research can be defined as “the systematic collection, organization, and interpretation of textual material derived from talk or conversation. It is used in the exploration of meanings of social phenomena as experienced by individuals themselves, in their natural context” [148], whereas the quantitative is described as a “systematic investigation of phenomena by gathering quantifiable data and performing statistical, mathematical, or computational techniques” [149]. From these definitions it is deduced that the qualitative approach is exploratory in nature, suitable to explore and analyse problems which are not well defined and understood. Therefore, new data and information are gathered to better identify them and formulate hypothesis. In contrast, quantitative research is usually confirmatory in nature because the problem is already defined and studied, hence the information is needed to test the hypothesis rather than formulating it.

Usually, in qualitative market research, data are collected and analysed through interviews, observations, or focus groups, and therefore the studied sample is small. Conversely, the quantitative method employs structured surveys, questionnaires, and experiments to gather information relatively to larger samples, usually of more than a hundred people. Surveys are typically administered online via computer, and they consist in a predefined set of close-ended questions to collect quantitative data. These data are then presented through charts, tables, and graphs.

For the purpose of this study, the qualitative research methodology represents the most coherent choice to analyse the perception of the interviewees toward plant-based products. Indeed, this approach allows to further interpret consumers behaviours by analysing the context. Consequently, the reasons motivating and limiting the consumption of those products – drivers and barriers – could be better explored (D. Rigoni, personal communication, 2021).

### 3.2.2 Qualitative approach: focus group, interview, and participant observation

Qualitative research can be conducted in a variety of methods, among which focus groups, interviews, and participant observations will be briefly analysed.

The focus group is a group interview consisting of a limited number of people discussing a specific topic among themselves. The conversation is led by one or more moderators, and the subject of the discussion is of interest to the mediator [150]. The advantage of this method is that by interact with each other, respondents are more likely to modify their opinions during the discussion and reach a shared judgement. However, besides the several advantages of this approach, cognitive problems may emerge during the discussion. For instance, it could happen that only the information shared by the whole group emerges, while more individual opinions remain hidden [151].

Interviews are interactive tools allowing the researcher to collect insightful data of respondents view points. Since interviews are individually carried out in natural settings, participants are more likely to express their own opinion and perspective [152]. According to Schostak (2006) [153], interviews are often regarded as "extendable conversation" between two people with the aim to collect useful and 'in-depth information' relatively to a specific topic, which can be further interpreted by the interviewer based on the participant's responses [154].

Another type of qualitative method is the participant observation, in which the interviewer observes a group of people in their natural setting and gain knowledge of the interactions, actions and events happening within the participants [155]. However, Johnson and Sackett (1998) [156] highlighted that participants observation may not be truly representative of the culture of the group, since the information gathered by the researcher are usually influenced by his interest and point of view [157].

Since interviews represent a more direct and convenient way to comprehend what the interviewee really thinks about the topic in question, this method was chosen over focus group and participant observation. Indeed, being a relatively recent topic, it may be possible that not all respondents have the same

level of awareness regarding plant-based foods. The questionnaire conducted during the interview included personal questions related to eating habits, so a discussion among the respondents would not have been appropriate. Furthermore, the interview included two techniques, laddering and picture-sorting, for which it was essential that participants gave subjective answers. Frequently, respondents in focus group influence one another by giving different responses based on what others say.

### **3.2.3 Qualitative interviews: structured, unstructured, and semi-structured interviews**

Interviews may be structured, unstructured or semi-structured. Within structured interviews, the examiner follows predefined questions, without deflecting from the original model. If on the one hand this allows to evaluate each interviewee objectively, on the other hand there is the risk of asking too impersonal questions, therefore it becomes difficult to actually understand the participant's opinion.

Instead with unstructured interviews personalized and subjective answers are obtained as the questions are not prepared in advance. This approach allows a greater flexibility from both the interviewer and the interviewee [154, 158]. At the same time this method does not allow to compare the answers of the interviewees precisely because the questions are different from each other.

Lastly, semi-structured interviews represent a combination between the structured and unstructured ones. The interviewer follows a basic checklist including a set of questions covering several topics [154], and based on the answers given he may ask additional questions or 'follow-up' questions to further investigate the participant's perspective [159].

The most suitable tool to gather data for this research is the semi-structured interview approach. It allows the interviewer to follow a schedule of questions, but at the same time to deepen some concepts through follow-up questions.

### **3.2.4 Research method: In-depth interviews**

The model of interview chosen is the semi-structured and in-depth interview. As the term recalls, the in-depth interview allows the interviewer to go deeper

reaching the root causes of certain behaviours by asking specific follow-up questions to participants. Indeed, respondents are encouraged to express their opinions and beliefs regarding certain topics as a way to extract more detailed information. [160] Another advantage of the in-depth interview is the possibility to create a connection between interviewer and interviewee, thus obtaining a sort of conversation that enables to acquire insightful replies [161]. For the aforementioned reasons, the in-depth interview model represents the most suitable tool to analyse and interpret the reasons motivating and discouraging consumers behaviours towards the consumption of plant-based products. It allows to analyse in-depth the perceptions of participants regarding these foods.

### 3.3 Sampling Selection

In this study, 30 respondents were interviewed (age range = 23-26, 16 females, 14 males). This sample size is consistent with the current recommendations of 15-30 respondents for qualitative research [162]. Interviewees were equally distributed into three groups according to eating habits in relation to the consumption of plant-based products. Precisely, the classification is the following:

- Group A: Omnivores not consuming plant-based products.
- Group B: Omnivores consuming plant-based products.
- Group C: Vegetarians consuming plant-based products.

It should be noted that the first group also includes those who have happened to consume plant-based products but do not consider them as part of their diet. The decision to segment consumers according to their dietary patterns relies on the notion that eating habits of individuals could affect the perception towards plant-based products.

The selected participants are university students living in Veneto. It has been demonstrated that younger generations, especially Millennials, display an increased positive attitude towards plant-based food, leading the market demand for those products [125]. Furthermore, higher educational levels have

been linked with an increased likelihood to purchase plant-based meat substitutes [140]. The decision of selecting people currently living in Veneto is to create a more homogeneous sample.

### 3.4 Interview Guide

A semi-structured questionnaire (Appendix) was created to allow the interviewer to follow a predefined set of questions, and at the same time to ask follow-up questions to deeply analyse the topic. To meet the different dietary habits of participants, the questionnaire included distinct questions. For instance, the vegetarian and vegan sample were asked how long they have switched from an omnivorous diet to a vegetarian or vegan one, and also what motivated their decisions. For this research, the subject of the interview – plant-based products – was not anticipated to participants. Respondents were told that the interview would be about their dietary and eating habits. The interview was divided in five sections:

1. Introduction

The first part of the interview had the goal to introduce the research objectives to interviewees and to briefly explain the scope of the study. This part further included a brief presentation of the interviewer and lasted two-three minutes.

2. Socio-demographic data

After having briefly introduced the object of the research, some basic questions were asked. The aim was to obtain data on the socio-demographic situation of interviewees (gender, age, education, occupation, location, household type) and on sport habits. This section required two-three minutes.

3. Eating habits and preferences

The third section aimed at understanding food preferences and the eating habits of the interviewees. General questions related to grocery shopping, dietary habits, and consciousness on nutrition were asked. This part lasted ten minutes.

#### 4. Perception and consumption of plant-based products

The fourth section introduced for the first time the topic of plant-based food. The goal was to understand if and how frequently the interviewees consumed plant-based products and whether there was a globally positive or negative perception of these alternatives. This section required fifteen minutes.

#### 5. Drivers and barriers to plant-based food consumption

The fifth section aimed at exploring the drivers & barriers of plant-based products through the laddering technique and Means-end chain methodology. According to the means-end chain approach, the functional characteristics driving the choice to buy, or not to buy, plant-based products are first identified. Then, the laddering technique is used to further elicit the interviewees to provide additional information motivating their choice. Therefore, the real values of participants are achieved, namely the drivers and barriers. This section lasted fifteen minutes.

#### 6. Implicit associations with plant-based products

The last section presented the picture-sorting technique. The purpose was to understand the spontaneous and implicit associations of interviewees regarding plant-based products. Thirty images were selected for this purpose. This section lasted ten minutes.

## 3.5 Conducting Interviews

Thirty interviews were carried out over a period of one month and a half, precisely from March to mid-April 2022. Part of the respondents was recruited for personal acquaintances, the rest by word of mouth.

The location and time of the interviews were agreed on the basis of the commitments and availability of respondents. Few interviews were carried out through video call on Zoom platform for logistical and organizational reasons. The Zoom platform was chosen to avoid time limits due to the use of the academic account of the University of Padova. The rest of the interviews were administered in person in different settings, including cafés, parks, pubs and

in some cases in interviewee's home in order to create a relaxing and familiar atmosphere. A friendly and relaxed tone was used to put the interviewee at ease.

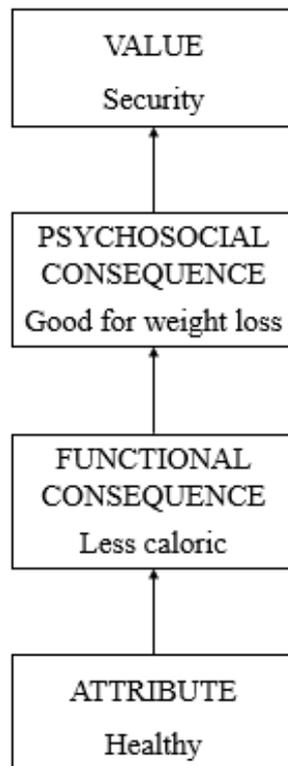
Before initiating the interviews, participants agreed to be recorded. The recordings were then used to transcribe the interviews. All the interviews were conducted in Italian, being the native language of all thirty participants. The interviews lasted an average of one hour.

### **3.6 Laddering Interviews & Means-end chain analysis**

Laddering interview is a qualitative approach commonly employed within a qualitative study design. It represents a useful tool to elicit consumer's preferences toward plant-based products, leading to a deeper understanding about their purchasing decisions [163]. Consumers preferences are organised in three levels: attributes, consequences, and values. Each level is linked to the next one and they all influence consumers buying behavior. Considering the current research, the attributes are the features of the plant-based product; for each attribute corresponds one or more consequences, which can be positive or negative, according to the consumer's perception; finally, these consequences are significant in terms of the interviewee's values. During the interview, the participant is asked to list all the attributes associated to plant-based food products. Then, the interviewer asks why-questions, or follow-up questions, to understand the real perception of consumers, first outlying the consequences and then the personal values, which are harder to reach [164]. This technique not only allows the interviewer to discover the attributes considered important to the consumer, but especially to reach the underlying values – functional and emotional benefits – deriving from the consumption of the product [163].

Laddering technique is centred on the means-end chain methodology. Their combination is useful to analyse the cognitive connections amongst consumers and food products, and therefore to study consumer's behaviour [165, 166]. The “means” are the attributes of the product and the consequences of buying plant-based product, while the “ends” are the consumer's values which are expected to derive from fulfilling the consumption of that product [164].

Means-end chain method is used to analyse how the interviewees link the attributes of a plant-based product with consequences, which can be positive or negative, and how they satisfy their personal values (D. Rigoni, personal communication, 2021). Figure 3.1 shows an example of the means-end chain analysis concerning the perception of several omnivorous consumers regarding veggie burgers.



**Figure 3.1:** Example of Hierarchical Value Map of the Means-end chain method for the question "Why would you eat plant-based meat substitute?".

## 3.7 Picture-sorting technique

Picture sorting is a method belonging to the card-sorting techniques family. It is a knowledge elicitation technique [167] since the way in which people categorize and organize their knowledge reflects the mental conceptualisation of their ideas [168]. In other terms, this method allows to understand how consumers categorize certain concepts subconsciously, thus influencing the decision-making process. Card-sorting is a powerful tool especially in mar-

keting research because it allows to understand how to report certain product information in order to attract consumers [169,170].

The card-sorting task is rather simple to achieve: participants are asked to sort items, which can be cards, pictures or words into groups [171]. There are different types of card-sorting methods, namely closed or opened, team or individual and manual or software card sorts. [170] For the purpose of this study, card sort was carried out with the use of pictures. This technique, called picture-sorting, is useful because participants are able to express themselves through the use of pictures, in a non-verbal way. It has been shown that this task does not require a great mental effort, so it is rather quick to carry out [167]. For this research, closed cart sort was chosen, according to which already predefined categories are set by the researcher, and participants are asked to organize items within these categories.

For this specific interview, participants were asked to group thirty pictures (Appendix) within two predefined categories: the plant-based and the meat categories. The first set is represented by an image of a plant-based burger (Image A.31), thus indicating vegetarian or vegan people who only consume plant-based food. The second category portrays a meat burger (Image A.32) suggesting an omnivorous diet based only on the consumption of meat, not including plant-based products. Each interviewee was given a deck of thirty cards, arranged in random order, which they had to dispose in one of the two categories. They were further asked to briefly describe the reason for their choice after categorizing the picture. For interviews conducted via Zoom platform, the process was quite similar. The interviewer shared the screen, showing the images one by one, always casually. No difficulties were experienced.

For this task, the images were not chosen at random, but according to a specified criterion. Pictures can be sorted out by six main categories:

- Age: young people, old people (Figure: A.1A.2,A.3A.4A.5A.6)
- Status: upper class, middle class (Figure: A.7A.8A.9A.10A.11A.12)
- Sports: fitness, competitive sport (Figure: A.13A.14A.15A.16)
- Masculinity: low, high (Figure: A.17A.18A.19A.20A.21A.22)

- Lifestyle: traditional, modern A.23A.24A.25A.26)
- Sustainability: environmentally friendly, consumerism A.27A.28A.29A.30)

The two opposite characteristics of the six categories have been chosen because they are likely to be associated with the consumption or not of plant-based foods. This facilitates the association of images to the vegetarian or omnivorous diet.



# Chapter 4

## Research Findings and Discussion

### 4.1 Introduction

As previously discussed, plant-based foods could represent a way to lessen the environmental impact of meat production, together with health benefits and animal welfare deriving from its consumption. The objective of this study is to understand the perception of university students towards plant-based products. For this purpose, qualitative interviews were carried out with the aim to identify the elements that motivate or demotivate the consumption of plant-based food, namely the drivers and barriers. In-depth interviews through an open-ended questionnaire were carried out for a total of thirty interviewees. In the following chapters, the findings will be displayed, discussed, and correlated to the academic literature, which is a useful tool to compare our findings.

### 4.2 Interviewees Characteristics

Within the second section of the open-ended questionnaire, specific socio-demographic data of the interviewees were collected. The goal of becoming acquainted with the subjects is to better understand their background, which may influence the consumer decision-making process regarding food choices. In Table 4.1, the socio-demographic data of the interviewees (n=30) are reported in line with the three categories of consumers.

A brief discussion of the data shown in Table 4.1 is necessary for research purposes. Even though there is an almost equal distribution of female and male

<b>Socio-demographics</b>	<b>Omnivorous plant-based refusers n=10</b>	<b>Omnivorous plant-based users n=10</b>	<b>Vegetarians plant-based users n=10</b>
<b>Gender</b>			
Female	4	5	7
Male	6	5	3
<b>Age (years old)</b>			
18-24	6	8	6
>25	4	2	4
<b>Education</b>			
Diploma	1	3	3
Bachelor's degree	7	5	7
Master's degree	2	2	0
<b>Occupation</b>			
Student	6	7	6
Employed	4	2	2
Unemployed	0	1	0
<b>Location</b>			
Belluno	0	0	0
Padova	3	3	1
Rovigo	0	0	0
Treviso	1	1	2
Venezia	0	1	1
Verona	0	0	3
Vicenza	6	5	3
<b>Household type</b>			
Living with family	9	7	4
Living with roommates	0	3	5
Living alone	1	0	1
<b>Sport (frequency)</b>			
> 5 times/week	0	0	0
3-5 times/week	2	1	2
1-2 times/week	5	3	3
< 1 time/week	1	3	1
Almost never	2	3	4

**Table 4.1:** Socio-demographic data of interviewees (n=30) divided according to their dietary habits

**Source:** data gathered from interviews (n=30) carried out for the current research

participants among groups, it should be noticed that the vegetarian and vegan sample is characterised by a greater number of women ( $n=7$ ). Although this may not be significant for this research, existent literature highlights the fact that women are more prone to conduct a vegetarian or vegan lifestyle compared to men [126,127,163]. Another element of discussion is the ‘occupation’ data. Several interviewees identified themselves as working students, the majority of which work during the weekends. However, this was not significant for the research since this data does not affect eating habits. The ‘location’ was intended as the place where respondents spent most of their time during the week. For instance, several interviewees are non-resident students, therefore the university city was taken into consideration.

## 4.3 Eating Habits

### 4.3.1 Introduction

Within the following pages, the eating habits of the thirty interviewees will be briefly described. The three research questions *Q1*, *Q2*, and *Q3* will be addressed and discussed. The data gathered from the interviews are divided in compliance with the three categories of diets:

- Group A: omnivorous not consuming plant-based food  
Those who consume meat regularly and affirm to not consume plant-based meat substitutes.
- Group B: omnivorous consuming plant-based food  
Those who report the consumption of a plant-based meat alternative (veggie burgers and meat analogues) at least once a month. This category of people does not define themselves vegetarian.
- Group C: vegetarians consuming plant-based food  
Those who follow a vegetarian or vegan diet, including the consumption of a plant-based meat alternative (veggie burgers and meat analogues) at least once a month.

The decision to maintain separated the information collected from the three categories was to optimize the analysis of the data and to facilitate the reading. The main questions centred on three topics (Appendix):

- Grocery shopping
- Eating habits and diet
- Consciousness on nutrition

By asking these questions to the interviewees, it may be possible to explore and comprehend what motivates or demotivates the consumption of plant-based food, hence the drivers and the barriers. This topic, together with the perception of plant-based products, will be deeply analysed in the following sections, which are specifically dedicated to plant-based food. Table 4.2 displays the summary of the most significant data regarding eating habits gathered during the interviews. The table includes four among the most important themes – grocery shopping, cooking meals, dietary habits, food awareness, changes in dietary patterns – and the illustrative quotes that emerged during the interviews.

### **4.3.2 Group A: omnivorous not consuming plant-based food**

Within ten interviewees, almost everyone affirms not being the main responsible for buying groceries. Apart from one student living alone, the great majority live with their family, so this task is usually carried out by their parents or by both parents and interviewees. This information is quite relevant because the consumption of plant-based food partially depends upon who is the responsible of buying groceries. According to the data gathered by this research, it has been shown that people who manage their own grocery shopping are more likely to purchase “unusual” food that is not belonging to their habitual diet. This choice could be simply driven by the curiosity of looking for something new, such as in the case of plant-based food. Being quite recent, this type of food is more present in the shelves of supermarkets, thus attracting new consumers who want to experience something new. This finding is in line

with other studies demonstrating that curiosity is a driver for the consumption of meat alternatives [132, 172]. Half of the students claim that grocery shopping is mainly carried out in the supermarket, once per week, while the other half cite that fruits and vegetables are often purchased by their family at the greengrocer, always once per week. In addition, meat is sometimes purchased at the butcher.

When asking the interviewees which are the elements that motivate their choice during shopping, all of them mentioned the price, in particular the price per kilo, clarifying that their choice is not toward the most expensive product but not even the cheapest one; one female student states *“for sure I look at the price of products, especially when I’m uncertain on which to buy. To be clear, I don’t buy the cheapest product because I don’t want something of poor quality, but also not the most expensive one”*. This could be explained by the fact that price is the most irrational element of the marketing mix – price, product, place, promotion – and consumers are not able to assign a price without a context. For this reason, they are not going to buy products with a very high or low price because it is associated with an irrational behavior. Additionally, participants mention to avoid very low prices in favour of higher quality of the products. Also in this case, there is the false conception that price depends upon quality, when in reality is the perceived quality that depends on price (D. Rigoni, personal communication, 2021). Another frequent response concerns the brand of products: almost all of them affirm to purchase the same brand as a way to assure the same quality of the product. According to a male student *“I always buy the same brand because it is the one that I usually consume at home, and I know that I like it”*. Curiously, six interviewees state to check the country of origin of raw materials. The motivations behind this behavior rely on two concepts: quality and sustainability. Our country, Italy, is a symbol of culinary excellences; therefore the “Made in Italy” is generally considered by the average consumer an index of high food quality. As for the environmental sustainability, some participants claim to favour Italian products to reduce the pollution caused by the transport of foodstuff. It is interesting to note that only two respondents claim to check the nutritional value reported in the label. This may be justified by the fact that one interviewee shows a great interest in his eating habits, especially in following a healthy lifestyle, while the other is

currently studying nutrition at the university. The first claims *“I prefer food high in protein because I have to follow a specific diet since I work out almost every day”*.

Within this group, only one interviewee lives alone, and four participants are currently working or taking an internship. For this reason, they affirm to lunch out five days per week. Specifically, except for one participant who usually eats in a canteen, the rest prefer to bring food from home. As for the other students living at home, they all affirm to not eat out. To facilitate the research, it was decided to take into considerations the average of weekly meals. According to the data gathered, eight interviewees out of ten claim that the main responsible for preparing meals during the week is another family member and occasionally they help to cook. Therefore, it is probable that the participants follow the same diet of their families, as *“my mom is in charge of cooking, since we all eat the same things”*. This information is quite relevant because the typical diet of the average Italian family is the Mediterranean one, which is characterised by a high consumption of fruits, vegetables, cereals, beans, nuts, and seeds, together with olive oil as the major source of monounsaturated fat; fish, poultry, dairies, and eggs are consumed in moderate amount, while the consumption of red meat and sweets should be limited [102](S. Maggi, personal communication, 2021). Lupi et al. (2015) [173] evidenced that students living at home tend to better follow the Mediterranean diet, namely the traditional one, compared to those living away from their family. By this statement, it can be assumed that the consumption of meat analogues by the nine interviewees is rather limited since this food do not belong to the Mediterranean dietary pattern. Meat is considered a “familiar food” and eating meat is an established routine typical of many traditional families, especially those with children. Since eating meat corresponds to following a well-established socio-cultural norm, it is possible to conclude that the eating habits of the family is a barrier to the consumption of plant-based products [143].

A more specific question regarding their weekly dietary habits was asked. The goal was to understand the frequency of the consumption of certain types of food, especially meat and meat products. Vegetables, together with fruits, are at the base of the food pyramid. Within this group, seven interviewees affirm to daily consume two to three portions of these nutrients. Three students

claim to consume a limited amount of vegetables and fruits, showing willingness to improve their weekly intake. Especially one male participant that is currently living alone claims *“I only eat vegetables at my parents’ house. Here, I only eat salads”*. All the interviewees affirm to eat every day at least a portion of pasta, rice, or other cereals as a source of carbohydrates. As a source of protein deriving from meat, two female interviewees claim to eat red meat with a low frequency during the week because they do not appreciate the taste of it, preferring poultry meat instead. Seven participants consume an equal amount of white meat and red meat, three to four days a week, and only one female student eat a portion of red meat daily, claiming *“in my family we eat everyday red meat because it is healthy”*. It is possible to appreciate a low consumption of cold cuts within six interviewees, while the rest claim to eat them almost daily. What unites nearly all the students is the limited consumption of eggs that reaches one portion per week. As for dairies, the trend is not the same of the previous food, since the majority of participants affirm to consume cheese, milk or yoghurt almost daily. Only one male student claims to drink soy milk as a substitute of the conventional one because of digestive problems; on the contrary, another male participant affirm to drink almost one litre of cow’s milk per day. The consumption of legumes within this group is limited, indeed only three interviewees state to eat legumes such as chickpeas, lentils, peas, or beans three times a week, while the rest occasionally. Even though fish should be consumed in moderate amounts, almost all the interviewees affirm to rarely eat this food. By analysing the data gathered through the interviews, it is possible to notice that the dietary habits of these young students do not fully adhere to the guidelines proposed by the Mediterranean diet. Even though all ten interviewees claim to follow a healthy diet, the consumption of red meat and meat products seems to be elevated. This could lead to a negative impact not only in terms of health, but also for the environment.

The last question is related to the desire of the interviewees to change somehow their diet. This information is asked to understand if there is the willingness to improve or reduce the consumption of specific types of food. One male respondent, which throughout the interview displayed a remarkable interest towards nutrition, claims to be willing to decrease the consumption of meat, especially red meat towards vegetarian alternatives. At the same

time, he mentioned to follow a diet rich in protein since it is required on a sporting level. For this reason, he is not willing to completely substitute meat with plant proteins because *“it is difficult to reach the daily intake of protein without meat”*. Five students express a similar interest in reducing red meat consumption toward a diet which includes a greater number of legumes, white meat, and eggs. Specifically, a female interviewee expresses the desire to definitely abandon the consumption of red meat, which is still included in her diet due to her parents’ eating habits. Another female student claims *“I would like to start eating tofu to reduce the amount meat”*. All three male interviewees which have previously affirmed to not consume sufficient portions of fruits and vegetables, replied that they intend to increase their consumption. Lastly, only one female student previously claiming to consume red meat every day is entirely satisfied with her diet, stating that *“I don’t want to reduce or improve the consumption of any food”*.

### **4.3.3 Group B: omnivorous consuming plant-based food**

Within this group, three students are currently living in the university city, sharing the apartment with roommates, and personally taking care of their shopping. According to the answers obtained during the interviews, four students claim to not overseeing grocery shopping, thus suggesting other family members as the main responsible for the task. The rest of interviewees affirm to contribute to carry out this task. Students living alone indicate as the main distribution channel the supermarket, even if occasionally it could happen to purchase fruits and vegetables at the farmer’s market. Five participants declare that fruits, vegetables, and meats are purchased apart from the rest of the groceries. According to their answers, this choice is primarily justified by the habits of their parents; one student claims *“My parents buy vegetables, meat, eggs and cheeses on a farm since the owner is a friend of theirs”*, and another female student declares *“On his way home from work, my father stops in Asiago to buy some fresh mountain cheese”*. Contrary, one student prefers to buy everything at the supermarket for reasons of convenience and one claims to go to a specific store only to purchase plant-based products. By comparing the two groups, students of the second sample show a greater awareness and interest in both health and environment-related topics and these are potential

reasons justifying an increased consumption of plant-based products. Furthermore, respect to the previous sample, several participants take care of their grocery shopping, contributing to a greater flexibility in their dietary choices.

Regarding the question of who oversees cooking, the variety of answers given by the participants is greater compared to the previous group. All respondents consume their meal at home, except for one off-site student who eats lunch at the university canteen. Since three students live in the university city, they are most likely to cook for themselves. As for the others, three affirm that this task is almost exclusively carried out by another family member. However, three participants prepare food for themselves since their dietary habits differ from the rest of the family. One female participant affirms “I always cook for myself because my parents eat differently, and sometimes I prepare for both myself and my parents”. Since this group consume plant-based food, it is more probable that their diet slightly differs from the one of their parents, which could be more traditional. Furthermore, the greater flexibility in dietary habits could justify the fact that most participants are responsible for their grocery shopping. Only one student affirms to be in charge of cooking for the whole family, and two participants declare that this task is performed alternately, depending on the personal commitments.

As for the previous group, the consumption of pasta, rice, bread, and other cereals represents the primary source of carbohydrates. Some students alternate the consumption of pasta with spelt, quinoa, oats, and whole grains to improve the intake of fibers. Except for one participant eating fruits and vegetables twice per week, the rest seems to be coherent with the dietary guidelines provided by the Mediterranean diet. Regarding the consumption of meat, it is possible to split the ten interviewees in two groups: five respondents eat meat in moderate amounts, while the others claim to consume it once per week during special occasions. As for the first group, only one girl states to favour the consumption of red meat because it is the most consumed in her family. Contrary, the rest of participants prefer white meat as they consider it healthier and with a better taste. Especially one male student affirms that “*I prefer to eat white meat instead of the red one, in particular poultry because it is leaner, and it provides a lot of protein. Since I go to the gym four to five times per week, I need a good source of protein to build mass*”. The second

group prefers to limit the consumption of red meat and meat in general because they consider it harmful for both health and environment and in some cases, they do not appreciate the taste of it. At the same time, all five students claim to eat meat during special occasions, for example when attending dinner with friends or with relatives. One male interviewee affirms that *“I only eat meat at my girlfriend’s house, since her father is a meat lover and I don’t want to make a bad impression by eating something else”*, and another female student claims *“when I go out to dinner with my friends and they want to eat a hamburger, I don’t want to influence them by asking to go somewhere else, so I rather eat the hamburger too. And to be honest, I sometimes enjoy eating it”*. Because the act of eating occurs in a social context, people tend to follow the so-called ‘social eating norms’. The author Higgs (2014) [174] observes that *“social eating norms are perceived standards for what constitutes appropriate consumption, whether that be amounts of foods or specific food choices, for members of a social group”*. By following eating norms, the need of affiliation with a group is satisfied. As in the case of the interviewees, it may be possible that the act of eating meat during special occasions is dictated by their willingness to be part of a group, which might be a family or friendship group. In line with this statement, a female student claims *“when I go to dinner with my family or my boyfriend’s family, I always eat meat because it would make me uncomfortable to eat something else”*. This perceived ‘social pressure’ deriving from the non-consumption of meat could be a possible driver limiting the purchase of plant-based alternatives, and more in general to switch to a fully vegetarian diet. However, this negative attitude especially applies to the act of eating out, therefore it should not influence the overall diet of participants. Contrary to the previous group, the consumption of cold cuts is very limited, and only one male interviewee eats turkey breast two times per week when he has insufficient time to cook a proper meal. Within this group, more than five students eat eggs four times per week. Regarding dairies, two students are lactose-intolerant; for this reason, their diet involves an average reduced consumption of milk, cheeses, and yoghurts, favouring those products with less lactose, such as aged cheeses. As for the rest, the consumption of dairies is rather moderate, and only one female interviewee eats them every day. Seven students prefer to consume a vegetable drink instead of conventional

milk, mainly for reasons of taste and health. For most of the interviewees, legumes are the basis of their diet. Eight students affirm to have increased the consumption of chickpeas, peas, beans, and lentils over the last two years. One male participant claims *“I eat legumes, principally those contained in veggie burgers”*. Lastly, as in the previous group, the consumption of fish is rather limited. Only one female interviewee affirms *“even though I reduced the consumption of meat, I cannot give up fish. I really like the taste of it, and also the nutrients contained in it, because it is very healthy”*. As previously anticipated, plant-based products have not yet been mentioned to prevent the interviewee to inform himself regarding this theme before the actual interview. Moreover, it may be interesting to understand if the participant mentions the consumption of plant-based food as part of the diet. For this purpose, only three interviewees out of ten claim to consume plant-based products, including veggie burgers, two to three times per week. As in the previous group, almost all participants consider themselves following a healthy diet and in general a healthy lifestyle. Although two students declare to not pay too much attention to their diet, the rest affirm to frequently read articles on the topic of nutrition. What emerges through these interviews is that several students show a great interest towards the sustainability issue; one female interviewee affirms *“I decided to reduce as much as possible the consumption of meat after having watch the documentary “Cowspiracy”. I must say that it has changed a lot my opinion regarding animal farms”*. Therefore, within the second group, the increased awareness regarding environmental and ethical issues related to animal-welfare act as facilitators for the consumption of plant-based products.

To introduce the analysis of the drivers and barriers towards the consumption of plant-based products as a meat substitute, an additional question was asked to this group. Interviewees were invited to explain the elements that would motivate and demotivate them to switch to a fully vegetarian or vegan diet. As already observed, most students seem to be strongly concerned about the environmental impact of meat, and this is an element positively influencing their dietary habits. Especially one female participant occasionally consumes meat to avoid wasting it, claiming that *“my goal is to fight food wastes, so if there are some meat leftovers, I prefer to eat them rather than wasting them”*.

Another girl affirms to consume a very limited amount of meat sold at the supermarket because it is commonly packaged in polystyrene. At the same time, the most common response for not changing dietary habits concerns the convenience and habits related to following an omnivorous diet. Eating only vegetarian or vegan requires knowledge and an in-depth examination of all the nutritional aspects related to it, with the aim to avoid possible dietary deficiencies which could be harmful for health. In particular, one male interviewee claims *“I have been vegetarian for six months, but then I decided to stop because I experienced some vitamins and minerals deficiencies”*. The decision for not becoming vegetarian or vegan partially depends upon the diet followed by the family or other social groups, including friends. As already mentioned, some students have the perception that by following a different diet they must renounce to certain occasions, such as eating with others. Moreover, one male interviewee who is willing to improve the consumption of plant-based foods as meat substitutes, find it difficult because of his family’s habits. He affirms that *“when I will live alone, I’m going to change my dietary habits especially by reducing meat”*. Even if the concept of familiarity and traditionality linked to meat is not as significant as in the first group, this could represent a barrier for the consumption of plant-based foods among omnivorous students. Except for one interviewee who demonstrates the desire to become vegetarian, the rest of the students seem satisfied with following an omnivorous diet. Seven participants are not willing to modify their diet in the future, while three students would like to improve the consumption of some foods such as fish, vegetables, and fruits.

#### **4.3.4 Group C: vegetarians consuming plant-based food**

Within the third group, four people are vegan, while the rest follows a vegetarian diet, even though three people are willing to become vegan in the future. Six interviewees live alone or with roommates, and four live with their families. Starting from the question “who is the responsible of grocery shopping?” it appears evident a difference compared to the first two groups. Indeed, all ten students affirm to personally go grocery shopping at least once every two weeks. This difference may be explained by two reasons. Firstly, within this group, half of the participants are currently living away from the family, therefore they

have to take care of this task by themselves. Secondly, they need to purchase food items specific for the vegetarian or vegan diet. This allows greater flexibility in dietary choices and facilitate the consumption of plant-based products. Even though most participants go to the supermarket, some students prefer to rely on specialised stores, which offer a great variety of plant-based products. The chain store that has been mentioned during the interviews is “*Natura Sì*”, which does not only sell vegetarian or vegan goods, but also organic and natural food products. By analysing the different categories, what stands out is that people who follow a diet based only on the consumption of plant-based food are more likely to look for specific certifications, as *Vegan*, *Organic* and *Fair trade*.

The main motivation driving the choice of consumers at the moment of purchase is the price, as in the other two groups. Almost all interviewees affirm to compare the price of similar products, taking also into consideration the brand name. Some specifically look for the brand they saw on some vegetarian or vegan cooking videos, while others prefer to buy the same brand because they already know the taste of those products. Almost nobody pay attention to the nutritional facts reported on the label. On the contrary, nearly all the interviewees carefully check the ingredients to assure that they are buying vegetarian or vegan products. Few respondents check the country of origin even if it may be a challenge when considering plant-based products. Indeed, they affirm that in some supermarkets, the choice of vegan products is rather limited, therefore it is not always possible to compare different brands. One interviewee affirms that “*I only check the country of origin if there is a lot of choice of products, which hardly happens when I go shopping at the supermarket*”.

Of the six interviewees living alone, only one claims to eat lunch out three times per week, while the rest prefer to eat at home or bring lunch from home. As for the others living at home, two female participants prepare lunch and dinner for themselves; this is due to the fact that they have commitments at different times and also because they follow a different diet compared to the family, so they need to prepare separate meals. Contrarily, the other two participants share this moment with their family. Especially one interviewee affirms that “*my sisters are vegans and my mother vegetarian, so we prepare everything together since we eat almost the same meals*”. The barrier of

unfamiliarity related to plant-based food is not perceived within this group. Furthermore, the eating habits of the rest of the family do not influence the consumption of vegetarian alternatives.

Between all three groups a daily consumption of cereals is appreciated, within which the most common are pasta, rice, and bread. At the same time, they consume other alternatives, including cuscus, bulgur, quinoa, legume pasta, corn pasta and so forth. Fruits and vegetables are an essential element of the vegetarian and vegan diet; indeed, all ten students consume two to four portions daily. It is possible to notice a difference when comparing people following a vegetarian or vegan diet to the other two groups, and especially the first one, where three omnivorous students declare to consume a very limited quantity of fruits and vegetables. When dealing with vegetarian and vegan diet, the variety foods source of proteins is more limited compared to the omnivorous one. Except for the consumption of eggs and dairies, which is not considered in the diet of the four vegan students, it is possible to affirm that no significant differences are present when comparing the two dietary habits. Indeed, three vegetarian students prefer to consume the least possible amounts of eggs and dairies, favouring the consumption of vegan cheeses, vegetables drinks and yoghurts. Also, the vegetarian sample claim to consume meat derivatives during special occasions, such as dinner with friends or family. Those students living in a different city from their hometown affirm to eat dairies and eggs only at their parents' home. All the participants consume a large variety of legumes on a regular basis. Most of the time they claim to eat whole pulses for convenience, but at the same time some interviewees affirm to prepare legumes in form of burgers, patties, meatballs, and falafels. Legumes are a significant source of both macronutrients and micronutrients. They are rich in complex carbohydrates with low glycaemic index, fibers, proteins, vitamins, minerals, and antioxidant. It has been shown that a diet rich in legumes and with a low consumption processed meats, refined grains and sugar is able to reduce the risk of type 2 diabetes. Other studies shown a positive impact of pulses in lowering both hyperlipemia and hypertension [175].

All participants claim to eat plant-based food at least twice per week, including tofu, tempeh, seitan but also vegetable burgers, meatballs, and cutlets. For instance, one female student affirms *“at lunch I usually eat a first course,*

*while at dinner a veggie burger as the main course because it is easy and quick to prepare*". Only one vegan male prefers to limit the consumption of those processed products, favouring whole pulses, vegetables, and cereals.

An additional question was asked to have a better understanding of the drivers towards the consumption of plant-based products. The question was "Since when did you become vegetarian/vegan? What motivated this choice?" According to their responses, vegetarian students decided to switch diet respectively for ten, eight, six, three and two and a half years. As for vegans, they have changed their dietary habits quite recently, over the last year. The reasons that led them to become vegetarians or vegans could be attributed to three topics: animal welfare, environmental sustainability, and health concerns. In line with the findings obtained in several studies [126, 135, 163, 176] the main reason leading towards a change in dietary lifestyle is the ethical issue related to animal-welfare. According to the information gathered during the interviews, nine people out of ten affirm that the main motivation behind this dietary choice is to favour the protection of animals. One female interviewee expressed herself by saying *"I do not eat meat because I consider it as if the animal is at the service of man"*, and another girl "by eating vegetarian you do not hurt animals". The desire of becoming vegetarian or vegan may be linked to unpleasant episodes happened in the past; one girl reported a specific incident *"I went on vacation with my family, and we got lost. Then we came out on a street, and I immediately saw a slaughterhouse. From that moment on, I no longer ate meat"*. Other students affirm to have seen documentaries testifying animal exploitation, as *Cowspiracy*, claiming that *"the majority, if not the totality of animal farms is intensive, so by buying meat we completely exploit animals"*. Only one vegan male interviewee affirms to not being too sensible in respect of animal welfare. In general, it is possible to conclude the ethical concerns regarding animal welfare represent a major driver towards the adoption of a diet based on the consumption of plant-based products. However, this reason is not shared by omnivorous students, so this driver specifically applies to the vegetarian and vegan sample.

According to data gathered during the interviews, another fundamental reason leading to a change in dietary habits is the environmental sustainability concern. However, this result is partially agrees with other studies [126, 135]

affirming that the main drivers towards the adoption of a vegetarian or vegan lifestyle are to be found in health and animal welfare-related motives. During the interviews, several vegetarian and vegan students affirm to prove a feeling of satisfaction and accomplishment by contributing to the reduction of the environmental pollution. One male student is currently attending the master's degree in "Natural capital and ecosystem services" and the other female student in "Local development", and both admit that their backgrounds influenced them to switch to an eco-friendlier diet. Interesting to note that the scholar studying Local Development affirms *"being vegan is a choice for yourself rather than for the environment. For example, intensive monocultures have a great impact on environmental pollution too, and even vegans eat those products"*.

Except for one vegetarian male who considers the environmental aspect to be the predominant one in his choice, several interviewees explain that at the beginning of their journey, the environmental issue was not of primary importance, and it didn't directly contribute to changing diet. However, some also explained that *"by becoming vegetarian you start to inform yourself on the benefits of this diet, and you start to become acquainted with all the topics surrounding it, including the environmental aspect"*. A significant difference compared to the other two groups is noticeable: people following a vegetarian or vegan diet are more likely to inform themselves not only on what to eat and not to eat, but on animal welfare, environmental sustainability, and health-related issues. Eight interviewees affirm to be updated by reading articles, watching documentaries and YouTube videos; many also claim to follow well-known personalities, including nutritionists, athletes, and actors in the vegetarian field through social networks. Despite the results obtained by some scientific studies [126, 127, 135, 176, 177], proving that health-related concerns are the major drivers towards the adoption of a vegetarian or vegan diet, the data gathered through these interviews show that only five students consider health of primary importance. Indeed, half of the interviewees is not particularly involved in the health benefits deriving from the non-consumption of meat. In general, they do not show interest in the topic of nutrition. Furthermore, one female student claims *"eating vegetarian does not mean eating healthy. I'm vegetarian but I still eat junk food"*. Indeed, this statement is

not entirely wrong. Nowadays, there is a wider variety of ultra-processed vegetarian and vegan food. Therefore, also a vegan diet could be rich in refined sugars, saturated fats, and salt [176].

Conversely, the other half of the interviewees are personally involved in the health-related topic. Particularly, one female student says *“I read two books regarding vegan nutrition, and I watched many documentaries. Vegan diet can prevent some diseases deriving from the consumption of meat, such as diabetes and cancer”*. Two vegan males both affirm that when they ate meat, they felt physically ill. That’s why they decided to become vegan. One reveals *“every time I ate meat I felt ill, especially red meat. Maybe there is a different absorption of nutrients compared to plant proteins. But since I decided to stop eating meat, I feel a lot better, both physically and mentally*. Again, the other vegan male reports a similar experience *“Now that I’m vegan I feel a lot better than before. In fact, before I used to eat both meat and legumes, and I suffered from intestinal disorders”, claiming that “it is not meat itself the problem, but the feed stuff used for the animals, rich in fats and antibiotics”*. Although the majority of interviewees do not perceive a significant difference in terms of health by changing dietary patterns, two participants confirm the opposite, showing a strong involvement and attachment to the vegan diet. By analysing the several responses, it could be concluded that for some interviewees, being vegetarian and especially vegan is a lifestyle rather than a mere diet. According to the data gathered by this research, health-related concerns should be considered as a driver towards the consumption of plant-based food, even if it seems to have a minor importance compared to animal welfare and environmental sustainability.

Less frequent motives attributed to the decision of changing diet is the taste of meat: four students claim to have never appreciated the taste and texture of it, in particular red meat. Consequently, the dislike of meat positively influence the consumption of plant-based foods, especially veggie burgers. Another reason relies on the influence of the dietary habits of the family. One female student affirms *“In my family, my mother is vegetarian, my two sisters are vegan, and my father is omnivorous but he eats very little amount of meat, only when he goes to dinner with his friends”* and another female participant states that *“my mother has been vegan for ten years, but now no more”*. In

opposition to omnivorous students not consuming plant-based foods, the concept of unfamiliarity related to meat-alternatives does not represent a barrier among vegetarians and vegans. On the contrary, meat is perceived as an ‘unfamiliar food’ by several participants. Lastly, the same question “would you like to change your diet?” was asked to this group. Seven people are satisfied with their diet, which they consider healthy, while three interviewees express the will to become vegan in the very near future. One student claims *“I want to become vegan in the next months, in fact now I’m reducing the consumption of dairy products and eggs”*.

In conclusion, by analysing and interpreting the data collected through the first part of the interview, some information related to the drivers and barriers for the consumption of plant-based products could already be identified. The act of doing grocery shopping highlights a difference between the groups, especially among vegetarians and omnivorous not consuming plant-based products. Being responsible of this task, as in the case of the third sample, could have a significant impact on the flexibility of the diet, and this could potentially lead to the consumption of “untraditional” foods, as in the case of meat-alternatives. Another difference consists in the dietary habits of individuals. The sample of omnivorous plant-based refusers show a limited consumption of vegetables and legumes when compared to the other two groups. These products represent the principal ingredients for the production of vegetarian alternatives, therefore potential reasons as taste preferences could limit their consumption.

Few drivers facilitating the consumption of plant-based products could be already defined. Animal-welfare, environmental sustainability, and human-health are the principal reasons motivating the sample of vegetarians and vegans to eat vegetable alternatives. Similarly, within the second group, several students show greater concerns regarding the environmental sustainability aspect, leading to the conclusion that ecological issues could represent the major driver for the consumption of plant-based products. Furthermore, few participants demonstrate interest in the theme of nutrition, so it is probable that their decision to reduce meat in favour of plant-based substitutes arises from health concerns. Differently, within the first group of omnivorous, it is still not

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possible to delineate the major drivers facilitating the consumption of these alternatives. However, a considerable number of respondents show willingness to reduce the consumption of meat. This positive attitude and the curiosity for new food could attract omnivorous consumers. It is possible to draw conclusions also on the factors limiting the consumption of these products. For omnivorous not consuming plant-based, it may be deduced that unfamiliarity and lack of knowledge regarding vegetarian alternatives play a significant role to the disadvantage of plant-based alternatives. Additionally, taste preferences and eating habits of the family could discourage the consumption of meat alternatives. Similarly, unsupportive family and friends, and the social pressure deriving from the non-consumption of meat are possible drivers limiting the purchase of PB alternatives for the second group. As for the vegetarian and vegan sample, not enough information was gathered, so it would be premature to draw conclusion at this phase.

Eating habits	Omnivorous plant-based refusers n=10	Omnivorous plant-based users n=10	Vegetarians plant-based users n=10
<p><b>Grocery shopping</b></p> <p><i>Illustrative quotes</i></p>	<p>-9/10 do not buy grocery themselves -8/10 pay attention to price -6/10 pay attention to brands -6/10 pay attention to the country of origin -2/10 check the nutritional facts</p> <p><i>“For sure I look at the price of products, especially when I’m uncertain on which to buy. To be clear, I don’t buy the cheapest product because I don’t want something of poor quality, but also not the most expensive one”</i></p> <p><i>“I prefer food high in protein because I have to follow a specific diet since I work out almost every day”</i></p>	<p>-4/10 do not buy grocery themselves -7/10 pay attention to price -7/10 pay attention to brands -3/10 check the nutritional facts -2/10 pay attention to the packaging’s material -1/10 pay attention to food voluntary certifications</p> <p><i>“I usually buy what my parents buy, so I know that it is of a good quality”</i></p> <p><i>“Whenever possible, I only purchase products wrapped in eco-friendly packages, avoiding those made of plastic or other non-recyclable materials”</i></p>	<p>-10/10 buy grocery themselves -9/10 pay attention to price -7/10 pay attention to brands -9/10 pay attention to ingredients -9/10 pay attention to vegetarian and vegan label -2/10 check the country of origin</p> <p><i>“I only check the country of origin if there is a lot of choice of products, which hardly happens when I go shopping at the supermarket”</i></p>
<p><b>Cooking meals</b></p> <p><i>Illustrative quotes</i></p>	<p>-8/10 do not prepare their own food -9/10 follow the diet of the family</p> <p><i>“My mom is in charge of cooking, since we all eat the same things”</i></p>	<p>-3/10 do not prepare their own food -3/10 follow a different diet from the family <i>“I always cook for myself because my parents eat differently, and sometimes I prepare for both myself and my parents”</i></p>	<p>-1/10 does not always prepare her own food -2/10 follow the diet of the family (vegetarian) <i>“My sisters are vegans and my mother vegetarian, so we prepare everything together since we eat almost the same meals”</i></p>
<p><b>Dietary habits</b></p> <p><i>Illustrative quotes</i></p>	<p>-7/10 eat vegetables and fruits on daily bases -7/10 eat meat three to four times per week -3/10 eat legumes three times per week</p> <p><i>“In my family we eat everyday red meat because it is healthy”</i></p>	<p>-9/10 eat vegetables and fruits on daily basis -5/10 eat meat two to three times per week -5/10 eat meat during special occasions -8/10 eat legumes in moderate amounts -3/10 mention the consumption of plant-based meat alternatives <i>“When I go to dinner with my family or my boyfriend’s family, I always eat meat because it would make me uncomfortable to eat something else”</i></p>	<p>-10/10 eat vegetables and fruits on daily basis -3/10 eat meat derivatives in moderate amounts -9/10 eat legumes on daily bases -9/10 eat plant-based food at least twice per week</p> <p><i>“At lunch I usually eat a first course, while at dinner a veggie burger as the main course because it is easy and quick to prepare”</i></p>
<p><b>Food awareness</b></p> <p><i>Illustrative quotes</i></p>	<p>-10/10 consider their diet healthy -1/10 is particularly interested in nutrition -2/10 consider meat essential for their diet</p> <p><i>“It is difficult to reach the daily intake of protein without meat”</i></p>	<p>-7/10 consider their diet healthy -8/10 are interested in nutrition -6/10 are aware of the several impacts of meat: environmental and health issues</p> <p><i>“I decided to reduce as much as possible the consumption of meat after having watch the documentary ‘Cowsspiracy’. I must say that it has changed a lot my opinion regarding animal farms”</i></p>	<p>-7/10 consider their diet healthy -9/10 are aware of the animal-welfare impact of meat -8/10 are aware of the environmental impact of meat -5/10 are aware of the health impact of meat -8/10 stay updated about vegetarian diets <i>“I do not eat meat because I consider it as if the animal is at the service of man”</i> <i>“By becoming vegetarian you start to inform yourself on the benefits of this diet, and you start to become acquainted with all the topics surrounding it, including the environmental aspect”</i></p>
<p><b>Changes in dietary patterns</b></p> <p><i>Illustrative quotes</i></p>	<p>-6/10 are willing to reduce meat -3/10 are willing to eat more vegetables -1/10 is not willing to change her diet -1/10 is willing to eat plant-based alternatives <i>“I would like to start eating tofu to reduce the amount meat”</i> <i>“I don’t want to reduce or improve the consumption of any food”</i></p>	<p>-9/10 are not willing to become vegetarian -7/10 are not willing to change their diet -3/10 are willing to consume more vegetables, fruits, fish</p> <p><i>“I have been vegetarian for six months, but then I decided to stop because I experienced some vitamins and minerals deficiencies”</i></p>	<p>-3/10 are willing to become vegan</p> <p><i>“I want to become vegan in the next months, in fact now I’m reducing the consumption of dairy products and eggs”</i></p>

**Table 4.2:** summary of data concerning eating habits of interviewees (n=30).

**Source:** data gathered from interviews (n=30) carried out for the current research

## 4.4 Consumption and Perception of plant-based products

### 4.4.1 Introduction

Within the third section of the interview, the consumption and the perception of plant-based products are explored. For this purpose, it appears to be consistent with the rest of the research to analyse the data separately, in accordance with the three groups taken into consideration. Compared to the previous part of the questionnaire, which is useful to obtain a general understanding of participants' perspective on the topic of nutrition, this section aims at exploring interviewees' opinions and beliefs towards plant-based products. The perception of both vegetable products (i.e., veggie burgers) and new generation of plant-based meat substitutes is discussed. Hence, the barriers and the facilitators for the adoption of these type of foods will be discussed in the following chapters.

Since the frequency of the consumption of plant-based products differ according to the dietary habits of participants, few separate questions were addressed to the three groups. The main questions asked to the thirty interviewees are listed in Appendix. Follow-up questions were needed to better explore the participant's viewpoint. Especially for vegetarians and vegans, it seems interesting to understand when they first introduced plant-based food, if before or after having changed their dietary habits. Indeed, it may be significant to understand if eating plant-based products could actually facilitate a reduction in meat consumption.

Table 4.3 and Table 4.4 report the summary of the principal drivers and barriers towards the consumption of plant-based food. "Drivers" are those attributes positively influencing the consumption of meat replacers, so they are considered facilitators towards the adoption of those vegetable foods. On the contrary, "barriers" include the negative attributes which interfere and limit the consumer's willingness to eat plant-based products. Since both traditional plant-based foods – those recalling the taste of vegetables and legumes, as veggie burgers– and the novel meat analogues – those recalling the taste, appearance, and nutritional properties of meat – are explored, their analysis of

drivers and barriers will be separated.

#### 4.4.2 Group A: omnivorous not consuming plant-based food

Since the participants belonging to the first group do not frequently consume, or consume at all plant-based products, it is important to first determine their knowledge towards this type of food. Eight interviewees are aware of the existence of both plant-based food and the novel generation of plant-based meat substitutes. Among them, participants define the first category as *“food only made from vegetables, cereals, legumes, such as veggie burgers”*, *“food that could be eaten by vegetarian people”*, and *“all those ready-made products with vegetables”*. Regarding the second definition, the most common answer is *“all those products similar in taste and appearance to meat but only made from vegetables and plant products”*. Interestingly, one male student defines them as *“products able to imitate the taste of meat, and also the culinary experience deriving from the preparation and consumption of it”*. All eight participants do not mention an important element characterising these meat alternatives, namely the nutritional value. By definition, novel plant-based meat alternatives not only aim at resembling meat in terms of flavour, texture, and taste, but also nutritionally. Only two participants admit having never heard of those products and not knowing the definitions. By intuition, one male student describes them as *“Everything that is vegetarian, so something that does not include meat. What come to my mind are products like tofu and soy”*, and the other male participant claims that *“plant-based food is everything that is vegetarian, while plant-based meat substitute refers to a product made from a mixture of both vegetables and meat”*.

In order to proceed with the interviews, the definitions of both foods were clarified to the respondents. Moreover, for simplifying the analysis, participants were told that both the aliments will be included within the term “plant-based food” till the end of the interview. According to the interviewees’ responses, the most known and cited products are the following:

- Veggie burger patties
- New generation plant-based burger, also called by many participants as

“fake burger” or “burger resembling meat”

- Traditional plant-based products, like tofu

Other recurrent plant-based products are cutlets, meatballs, sausages, and nuggets. Only one male participant mentions the existence of vegetable drinks, vegan cheeses, and cold cuts. It could be noticed that interviewees' knowledge of plant-based foods is rather limited, especially when compared to the other groups. This lack of knowledge about vegetarian and vegan alternatives could limit the consumption of those products. Few studies found out that one of the strongest barriers to the consumption of plant-based food is the lack of information regarding the ingredient composition, the production process, the nutritional value, the health and environmental benefits related to its consumption [121, 131].

It is possible to affirm that all ten students have eaten at least once in life a plant-based food among veggie burgers and similar products, and only four of them have tried the new generation plant-based meat alternatives. Four participants recall having bought plant-based products for different reasons, among which the most significant is curiosity. As found out by other studies, curiosity may lead consumers to try new foods [172], but at the same time this motivation is probably not going to work in the long run [132]. Only one student described a particular event claiming *“I once bought that food (novel generation PBMA) mistakenly: the term “Burger” was reported on the label and I didn’t read it carefully, and when I ate it, it was everything except from meat. It was rather disgusting in my opinion. I regret buying it”*. As for the other six students, they happened to eat plant-based foods because “my vegan friend made me try it”, or “my mother doesn’t like meat, so sometimes she buys veggie burgers and I happened to try them”. Except for the student who has mistakenly bought the novel generation vegetable meat substitute, and who is clearly showing aversion towards this type of product, there is a general positive perception from the other participants.

It appeared coherent with the analysis to directly ask to the interviewees “What do you think about plant-based products?”. However, it should be taken into consideration that some of their responses could be biased by the desire to look good in front of the interviewer. Actually, throughout the

interview, all the respondents were at ease, and their answers seem to be truthful.

All ten candidates affirm to not appreciate the “concept” of the novel generation of meat analogues. What bothers them is that *“these products want to resemble meat at any costs”*, claiming that *“they could mislead the consumer by writing in the label “Burger”, “Sausage” and so on”*. A probable explanation is that by reading the terms “burger”, “wurstel” or “ham” which usually refer to meat, associated to the word “vegetable”, “vegetarian” and “plant-based”, there is a sort of contradiction and dissonance [142] which is perceived as negative and, in some cases, also misleading and irritating. According to the research carried out by Szejda (2019) on consumers perceptions of plant-based descriptor terms [178], products including the word “plant protein” and “plant-based” appeared more attractive compared to those terms including the word “meat”, such as “meat substitute” and “plant-based meat”. Moreover, as previously assessed, many conventional meat-eaters are strongly tied to culinary traditions, especially for those students still living at home with their parents. In fact, one interviewee claims that *“if I have to choose between real meat and fake meat, I’d prefer the real one, since I can eat it because I’m not a vegetarian”* and another one *“since I already eat a low amount of cold cuts, I’d rather eat those instead of the vegan ones. As for cheeses, I eat them every day and I would never substitute them with the vegetarian alternatives”*. What emerged is that participants consider the consumption of plant-based products more suitable for people following a vegetarian or vegan diet, who wants to recall the experience of meat by eating those meat substitutes. Meat alternatives are considered to be unhealthy since they are *“too processed and unnatural”*. Some interviewees seem to be concerned about the composition of those products, stating that *“I don’t know how they could replicate meat; it is not clear the process”* and *“I think that they use a lot of additives and salts to mimic the taste of meat. It is very unnatural and unhealthy”*. In opposition to meat which is described as a *“very natural food”*, these novel plant-based products are considered not only artificial, but also bad for health. The lack of knowledge, together with the distrust of food technology in relation to plant-based products may represent a significant barrier towards the consumption of it [132]. However, a remarkable difference of consumer’s perception when

considering veggie burgers and imitation meat is noticeable. Indeed, as for the rest of plant-based foods, including vegetable burgers, nuggets and so forth, the opinion of participants is generally positive since these products are considered more healthy and less processed by being composed of vegetables, legumes, and cereals. In accordance with the results gathered, the vast majority of omnivorous students show willingness to reduce meat consumption for health purposes. In line with the findings of other studies [121,124,134], health represents a facilitator towards the adoption of a plant-based diet, since several participants believe that the traditional and most common vegetable products could be a healthier alternative to red meat. For instance, one female interviewee claims *“I’ve heard that red meat is dangerous for health”* and another *“if you eat too much red meat you can get cancer or other diseases”*. Only one female respondent, who throughout the interview affirms to consume red meat every day, claims that *“red meat is healthier than all plant-based foods because it is natural and untreated”*.

Another perceived barrier is the taste and texture of the novel generation meat alternatives, which are considered different compared to the conventional meat, according to whom have tasted the products. In fact, by reporting in the label the term “meat”, consumers expect the product to match the same organoleptic characteristics. If these expectations are not met, consumer’s willingness to buy those products inevitably decreases. According to the results of the interviews, regular meat consumers largely prefer the taste of conventional meat, while the other two segments of participants appreciate the taste of plant-based meat alternatives. This outcome is in line with existing literature showing that people regularly consuming meat substitutes evaluate those alternatives better than meat in terms of taste [139]. For instance, one participant affirms *“I have tasted three to four plant-based foods in my life, and I liked them all except for one fake burger which was so disgusting I wasn’t even able to finish it”*, and a female student expresses *“I happened to eat some veggie burgers and also a sausage that wanted to resemble meat, but the taste was very different from the original and it was unpleasant”*. As regards veggie burgers and similar products, almost all students affirm to appreciate the taste because they *“taste like veggies”*, *“they are very flavourful”*, *“I can eat different combinations of vegetables that I like”*, *“they have a natural taste”*

and because *“the taste is usually coherent with what is reported in the label. . . for example if there is written ‘burger with zucchini and eggplants’ I already know what to expect”*. Only one student shows aversion towards these products, stating *“I have eaten a veggie burger made of broccoli and I didn’t like it because I generally don’t eat broccoli, and the texture was crumbly”*.

Plant-based foods largely vary according to the combinations of ingredients used for their preparation, such as vegetables, cereals, legumes and so forth. Hence, as for many other foodstuffs, the likeability of plant-based products, like veggie burgers, strongly depends on personal taste. However, the great majority of participants seem to like this type of product because of its taste, so there is a general positive perception. It is not possible to affirm the same when considering the novel generation PBMA, because the taste and the appearance expected from consumers are the one of meat, so it should not significantly differ between brands. Still, different ingredients formulations are used for manufacturing these plant-based meat alternatives, consequently the taste, together with the appearance and the nutritional values can be different.

A perceived barrier to the consumption of plant-based food is the satiety effect and protein content, which especially concern the veggie burger typology. Two male interviewees, which are particularly interested in reaching their daily protein requirement, affirm that *“It is difficult for me to eat veggie burgers because they don’t provide enough proteins”* and *“If I eat a vegan burger after I have to eat something else because it doesn’t fill me up”*. On the contrary, animal-based products are considered high protein and satiating foods. These results are in line with the findings observed by Reipurth et al. (2019) [122], concluding that people who eat high amounts of meat-products are more likely to consider plant-based foods low in proteins and not satiating.

When asking *“would you like introduce plant-based products in your diet?”* participants show different interests. From one side, six students are willing to start to consume veggie burgers because it represents a way to vary the diet and to improve the consumption of vegetables and legumes. The consideration of vegetable burgers as *“healthier”* and *“more natural”* than meat is shared by many omnivores. Moreover, one male interviewee claims that *“if the production of plant-based products is truly sustainable, I could take into consideration to consume them once per week”* and another female student affirms that *“If I*

*wasn't intolerant to wheat, they would already be part of my diet*". The other four students do not show willingness to start to consume those products on a regular basis, claiming to prefer keeping following their diet, which they consider healthy. The belief of students that their diet is already healthy enough is an attitudinal barrier which interferes with the changes in dietary habits [131,138]. Moreover, also unsupportive families may contribute to limit the consumption of meat alternatives, since they could represent a barrier to alter participants' dietary patterns [131]. This statement especially holds true since this research is considering university students, including those who live at home with their parents and are still tied to their families' eating habits.

Lastly, only one student claims *"I never had the courage to buy fake meat products because I do not know how they could taste, and this aspect intimidates me"*. This may be classified as food neophobia, meaning "the reluctance to eat, or the avoidance of new food" [179]. Even though food neophobia is usually higher for other meat alternatives, including insects, algae, and cultured-meat, [123,125,129,132,141,142] it still may represent a barrier for the consumption of plant-based food. In the light of the overall answers obtained during the interviews, students consider themselves more prone to introduce in their diet the most common plant-based food, including veggie burgers, nuggets and meatballs. Conversely, a possible increase in the consumption of the 'faux meat' is not contemplated.

Since eating meat is a well-established social norm, the last set of questions aims at exploring the perception of plant-based products in social contexts, including dinner with friends and at the restaurant. All the interviewees affirm to know someone regularly consuming plant-based products, who are not necessarily vegetarians or vegans. The responses to the question "If you were to host vegetarian or vegan friends, would you prepare a ready-made plant-based food or something from scratch?" are not very different between each other. Many students admit that this situation would hinder them, because it would be something never experienced before and because they are unfamiliar with these two diets. However, nine interviewees claim to prefer cooking something from scratch, as *"I prefer to personally cook for my guests, without buying already-made meals"* or because *"I don't know how to cook plant-based products"*, while only one female student is willing to prepare a ready-made

plant-based item.

The lack of knowledge of plant-based foods represents one of the greatest barriers to the consumption of these products. Indeed, most of the interviewees display poor knowledge regarding the ingredient composition, health-related aspect, and the culinary preparation of meat substitutes. The research carried out by Varela et al. (2021) [142] confirms that the lack of knowledge and self-confidence of consumers about plant-based foods hampers their consumption, and the lack of practical culinary knowledge is probably the main barrier. Among the three segments, only this group, which is characterised by the higher intake of meat products, perceives cooking meat alternatives as difficult [122]. Lastly, to the question “If you found a plant-based burger on the restaurant menu, would you buy it?” four respondents claim to be willing to experience that food, while the rest would prefer to order the conventional burger. However, those contemplating the possibility of eating meatless burger state *“well, I would be open to eat a veggie burger, but knowing myself I would probably stick to the real one”*. Few students justify the choice of not ordering the plant-based one saying that *“I rarely go to restaurant, so I prefer to eat something that I actually like”*. Since taste is the most important attribute to consumers [180], and during the interviews many students have shown to like the taste of meat, these behavioural choices regarding food consumption are rather predictable.

#### **4.4.3 Group B: omnivorous consuming plant-based food**

From the first question “Have you ever heard of “plant-based food” and “plant-based meat”? Could you define them?” it is possible to appreciate a greater awareness compared to the first group. Indeed, almost all the interviewees define those products correctly and with more detail. For instance, one girl claims *“plant-based food refers to the plant-based diet, which includes the consumption of vegetables, legumes, fruits and also meat substitutes such as soy yoghurt, vegetable drinks, veggie burgers and meatballs, and so on. . . ”* while another one defines plant-based meat substitutes as *“food made from plant products, especially soy proteins, that wants to mimic the taste of meat, with the addition of additives and particular ingredients to replicate the juicy texture of meat. . . such as beetroots”*. Only one student affirms to have never heard

the term “plant-based meat substitutes”, but still knows the product. According to the collected answers, participants provided a wider range of plant-based products respect to the previous group. The most cited are vegetable burgers, meatballs, and nuggets. Other recurrent products are traditional plant-based alternatives, including tofu, seitan, and tempeh; plant-based dairies, such as cheeses, yoghurts, cream cheese, cream, and milk; sausages, cutlets, and cold cuts. However, compared to the previous group, new products are named, including chicken flavoured soy strips, soy ragù, vegan ground meat, chickpeas bresaola, and vegan tuna.

The average consumption of plant-based products stands at one to two times per week. Participants claim to eat especially tofu, vegan dairies, veggie burgers, meatballs, and nuggets. Conversely, the consumption of plant-based cold cuts, ground meat, soy strips, imitation burger, sausages and tuna are less common since these products are the latest in the market. Moreover, participants choice of limiting the consumption of those peculiar plant-based foodstuff is attributable to several reasons, including taste, texture, price, ingredient composition and health-related aspects.

The likeability of a product strongly depends on the taste of it, and this attribute is expected to influence the choice of consumer at the moment of purchase. Indeed, few students claim to not buy vegan cold cuts because “*they have a chewy texture and taste like plastic*”, or “*it was so spicy I wasn’t even able to finish it*”. Similar descriptions also apply to vegan cheeses which “*tasted like plastic*”, and sausages that are described having a “*chewy consistency, completely different from the real sausages*” and “*too spicy*”.

Differently from the previous group, novel generation plant-based meat alternatives are accepted by most participants. During the interviews, what emerged is that students do not completely embrace this type of product, but they rather show a neutral attitude towards it. This result is shared by the study of Hoek et al. (2011) [129], demonstrating that moderate consumers of meat substitutes gave almost equal ratings to both conventional meat and plant-based meat alternatives when considering taste. One female student claims that “*the taste of fake sausages was very different from the original, but it didn’t bother me*”, and another one “*I once tasted a (novel generation PBMA)*

*sausage and I really liked it because it resembled meat in terms of taste*". A male participant affirms *"I don't mind the idea of these fake products, as long as they are not heavy to digest"*. It is possible to conclude that students belonging to Group B do not display the feeling of bother and disgust of those from Group A, proving to be more open to the idea of new foods. Therefore, the perceived barrier represented by food neophobia – fear of trying new foods – of the first group does not apply to this case. It could also be implied that the barrier of traditionality and familiarity concerning the high meat intake, which strongly limits the consumption of plant-based products in Group A, is less prominent. However, the preference of participants is still towards more traditional plant-based products, which include not only tofu and seitan, but also veggie burgers or any products of which the taste is attributable to the specific vegetables and legumes reported in the label. Indeed, vegetable burgers are often described as *"delicious"*, *"flavourful"*, *"appetizing"*, *"tastes natural"*, thus making these positive attributes the main motivation justifying consumer's choice toward veggie burgers.

Price is another element strongly influencing food related choices. As previously discussed, almost all thirty participants affirm to consider price when going grocery shopping. According to the gathered answers, several interviewees perceive this attribute as a barrier to the consumption of peculiar plant-based aliments. Some students affirm *"I would eat more of this (plant-based burger) but sometimes it costs too much"*, *"I would like to try vegan cheese, but it costs a lot"*, *"I've eaten a fake burger at the restaurant, and it was delicious, but normally it costs too much so I prefer to eat it once in a while"*. On average, the price of novel meat analogues is perceived by some students to be higher compared to other plant-based foods, claiming that *"instead I prefer to directly eat meat since they have a similar price"*. This result is in line with the study of Gebhardt (2020) [124] showing that high prices of plant-based products represent an important reason for consumers to limit the consumption of meat alternatives. However, this result does not equally apply to veggie burgers and other similar plant-based stuff, which are considered more affordable: *"I prefer to buy veggie burgers because they cost less"*, *"you can find many more offers"*. Again, more simple plant-based alternatives are the ultimate choice for many consumers. Even though price has been iden-

tified as a barrier to the consumption of plant-based products, especially the novel generation one, few students perceive it more competitive when compared to meat. One participant states *“if you buy meat at the supermarket it’s more convenient, but I usually buy it in the butcher’s shop. . . I think that on average, plant-based substitutes are less expensive”*.

Several students reported similar concerns to the previous group regarding the ingredient composition of these foods. Also in this case, few interviewees perceive plant-based products as *“unnatural”* and *“processed”*, and these opinions and beliefs represent a potential barrier to the consumption of plant-based food. Indeed, some students state *“I like them (meat alternatives) but I don’t want to eat them more than two times per week because they are too processed in my opinion”*, *“since I do not know the ingredients inside, I usually prefer to eat whole pulses as a source of protein”* and *“instead of eating veggie burgers I usually prefer to eat the vegetable itself”*. However, one female student specifically says that *“I don’t really know what’s there inside (plant-based burger), but I know that it is better than eating meat. Although there may be preservatives that in the long run are more harmful than meat, in environmental terms these are much better”*. According to this participant, the environmental benefit deriving from the consumption of plant-based food is the major reason justifying her dietary choices.

Regarding health-related topic, this concept should be considered ambivalent. If from one side the consumption of meat should be reduced for health reasons, from the other side, an excessive consumption of plant-based products is believed unhealthy. For instance, by consuming meat alternatives of certain brands, one interviewee experienced *“stomach acid because in many plant-based products there are too much species”* while another one claims that *“both veggie burgers and fake burgers are not so healthy in my opinion. . . they are little and at the same time the energy content per piece is too high. Also, they have too much salt”*. However, this idea is often associated to the novel generation PBMA, which are considered to be less healthy than the common veggie burger. Despite these statements, all interviewees consider plant-based ready-made products a healthier option than red meat and processed meat, motivating their decision to introduce those foods in their diet.

As already mentioned in the analysis of interviewees food habits, the in-

roduction of plant-based food in the diet should be attributed to a variety of different reasons, among which environmental and health related topics are predominant. As a matter of fact, five students started to eat plant-based food as a way to contribute to the reduction of the negative impact caused by meat industry. Several participants share the opinion that the negative effect deriving from intensive farming is one of the causes of environmental pollution. According to a survey carried out in 2018 [181] the 75% of Millennials are more likely to change their habits for environmental purposes compared to 34% of Baby Boomers. This trend also applies to food related choices, since 80% of Millennials regularly purchase meat substitutes [182]. On average, young adults have a throughout knowledge of environmental issues and are more concerned about this topic compared to seniors [125].

This could also be applied to health-related topic. For instance, six students attribute their choice of consuming plant-based products to health reasons, suggesting that meat substitutes are healthier compared to conventional meat. Also in this case, Millennials show to be more health-conscious compared to other generations [183], and this is reflected by their willingness to reduce meat [125]. In conclusion, the greater knowledge towards certain thematic, principally concerning environment and health, is a facilitator towards the consumption of plant-based foods.

In few cases, familiarity with plant-based meat substitutes is a reason positively influencing the choice of two students. One female participant declares that *“my sister is vegan, that’s why I started to consume those products”* and another *“my family has been vegetarian for years, but now no more”*. Another reason favouring the consumption of these products is the ease of preparation: few students claim to eat veggie burgers at least three times per week since they are very quick to cook because they are a ready-made product. In accordance with this finding, the research carried out by Reipurth et al. (2018) [122] demonstrates that those consumers perceiving cooking plant-based products simple and effortless, are more likely to have a low intake of meat. Hence, the apparent ease of preparation is a facilitator towards an increased consumption of meat alternatives. Lastly, one participant, who has previously admitted consuming vegetables and fruits once per week, decided to implement plant-based food in his diet *“as a way to eat more vegetables and legumes, since*

*these burgers usually have a lot of spices which cover the taste of it”.*

The question “If you were to host vegetarian or vegan friends, would you prepare a ready-made plant-based food or something from scratch?” received several responses. Firstly, this hypothetical situation does not represent a challenge as it was perceived by the previous group. Actually, almost all participants claim to have hosted several dinners with vegetarian or vegan guests. Secondly, the technical lack of knowledge perceived by few omnivorous students of Group A does not apply to this group. Instead, five respondents claim to prefer buying plant-based meat alternatives because they are “*easier to cook*” and they “*require less time*”.

As for the rest, they would rather cook some vegetarian or vegan dishes instead of buying ready-made plant-based foods, motivating this choice by saying “*I really like to cook*” or “*I know many vegetarian recipes, so cooking wouldn’t be a problem*”. Lastly, when asking “Would you prefer to order a plant-based hamburger or a meat burger at the restaurant?” similar responses to Group A could be appreciated also in this group. Indeed, only four interviewees would prefer to purchase the meat alternative hamburger. It may be possible to conclude that also in this case, taste is the major element driving food related choices, and most students claim to like the taste of meat. It should be also noted that eating at the restaurant could be perceived by consumers as an event or something out of the ordinary. As a consequence, people indulge in the pleasure of eating foods they perceive more appetizing and that they do not normally eat during the week.

#### **4.4.4 Group C: vegetarians consuming plant-based food**

According to the data collected and analysed through the interviews, the vegetarian and vegan sample clearly shows a broader knowledge of plant-based products compared to the other two groups. Consequently, the lack of knowledge is not a barrier for the consumption of these products. Except from one female student who does not know the definition of novel plant-based meat alternatives, the other participants are evidently familiar with both terms. Interestingly, only one female interviewee describes meat alternatives as “*vegetable food that mimics the taste and the texture of meat*”, pointing out for the

first time *“together with the nutritional values”*.

Another vegan student, when defining imitation meat, expressed his opinion by saying *“It is a way to give an alternative to those who do not want or cannot consume meat. To avoid weighing the choice or the obligation of being vegetarian or vegan”*. In contrast, a male participant considers that *“Plant-based meat is a wrong term, because you want to pass an animal product as something suitable for vegans, while in reality it is not. They should simply call it ‘soy burger similar to meat’ instead of ‘plant-based meat burger’”*. As previously discussed, terms as “plant-based” and “plant proteins” should be preferred instead of labels including the word “meat”, since this could trigger some consumers [178]. However, it may be noticed that within ten interviewees, just one finds the term irritating. Lastly, one female student claims to know cultivated meat products, suggesting that *“I didn’t like them because they tasted exactly like meat”*.

On average, the frequency of consumption of plant-based products is almost daily for certain types of food, including vegan yoghurts and drinks; however, veggie burgers and similar products are eaten one to two times per week, except from two students consuming these foods daily and one student monthly. Apart from some exceptions, the consumption of plant-based items is comparable to the previous group. The difference is that vegetarians and vegans consider those foods as an actual substitute for meat, while the others alternate meat with plant-based products.

When asking “Could you name some plant-based products?” an extensive list of foods has been compiled. Beside the most common food items, such as veggie burgers, plant-based meat burgers, tofu, seitan, nuggets, sausages and cold cuts, unusual products have been mentioned. It is the case of soy ragu, soy stew, chicken flavoured soy strips, “sfilacci” (the term *sfilacci* usually refers to thinly sliced threads of salt-cured smoked horse thigh), kebab, fish sticks, frozen pasta with vegan ragu, dumplings with seitan, soybeans granules, bacon, cordon bleu, and chicken burger. However, the consumption of these products is limited when compared to conventional plant-based items. As in the previous group, veggie burgers represent the first choice of consumers. A possible explanation is that these vegetarian alternatives are among the first to be marketed, hence their presence in supermarket is well established.

Moreover, almost all interviewees display a marked preference towards the classic plant-based products because of the taste, which is often described as “*tasty*”, “*spicy*” and “*delicious*”. All students seem to appreciate vegetable burgers because “*they taste like vegetables*” and “*there are many flavours*” which could satisfy different tastes and vary the diet. These opinions are in line with the previous samples of omnivorous claiming that veggie burgers are a suitable alternative to the consumption of whole vegetables and legumes.

Even though veggie burgers and similar products are the leading choice, meat analogues are appreciated by almost all interviewees. Three students seem not accepting those products because “*they taste like meat, which I don’t like*”. From one side, these foods have been created to attract a specific target of consumer who is looking for a similar product to meat [129]. But from the other side, consumers who already avoid the consumption of meat for its taste, are going to dislike every food that resemble it [137, 184]. Therefore, the dislike for meat’s taste acts as a barrier for the consumption of meat analogues, while it is a facilitator towards the adoption of veggie burgers since they often taste like vegetables and legumes. This statement especially holds true when considering vegetarians and vegans; when discussing dietary habits, some interviewees described the willingness to avoid the taste of meat as a factor influencing their food choices towards the adoption of a vegetarian or vegan diet.

It should be discussed that meat analogues – products resembling meat taste – have been created to attract a wider range of consumers, spacing from omnivorous to vegans. According to the results of the interviews, omnivorous students frequently eating conventional meat are those showing the lower willingness to purchase those products especially due to taste preferences. By eating meat every day, they do not perceive the need to consume an alternative which tries to mimic the taste of meat. These considerations especially apply to heavy meat-eaters and meat-lovers, whereas imitation meat could represent a plausible alternative for “flexitarians” and meat-reducers, such as the students belonging to the second sample. As previously mentioned, not all vegetarians and vegans appreciate the taste of meat, therefore meat analogues are more likely to attract only those individuals specifically looking for products resembling that peculiar taste.

Once again, most students justify the low consumption of novel plant-based food by focusing on the ingredient composition. Some interviewees claim that *“this type of food is not so healthy since there are a lot of unneeded ingredients that make it less digestible”*, and *“they are too processed, they add a lot of ingredients to make it like meat”*. According to their responses, the difficulty in digesting those food derives from the presence of additives, including *“food colorant”*, *“flavour enhancer”* and *“spices”*, especially garlic and onion. In contrast veggie burgers and other more traditional plant-based products are described as *“more natural”* and *“less processed”*, leading to an increased digestibility. However, one female student affirms buying only products resembling meat, including *“vegan chicken burger”*, because *“I like the taste of it... moreover, I’m able to prepare the veggie ones at home”*.

In line with the previous group, for most participants, price represents a barrier for the consumption of new generation plant-based products, which are considered by few respondents *“too expensive, especially compared to the veggie burger”*. Two female students share the same opinion on those products, claiming *“I buy it occasionally to allow myself a sweet break because they are very expensive”*. Also, within this group, the belief that veggie burgers are less expensive is another element strengthening their consumption. Moreover, many students consider plant-based foods cheaper than conventional meat.

As previously assessed, almost all students reiterate that the main motivations leading their choice towards the adoption of a vegetarian or vegan diet are to be found in animal-welfare, environmental and health-related concerns, where ethical issues represent the primary motivation justifying the consumption of plant-based products. Lastly, even though the availability of meat substitutes is slightly increasing [122], it still may represent a limit to the consumption of plant-based foods. Especially for those participants living in the countryside, the scarcity of well-furnished supermarkets restricts the choice of consumers, who are more likely to purchase common plant-based products, including tofu. As few interviewees say, *“I would like to eat more cold cuts, but it is difficult to find them in my supermarket”*, or *“I have to go to a specific supermarket to get my fish sticks, and it is a bit far from home”* and *“I would like to try different flavours of veggie burgers”*.

When asking “when did you introduce plant-based foods in your diet?” similar responses were collected. Almost all students started to eat these products recently, for reasons of price, availability, and variety. According to their declarations “*compared to the past, now there are more products and the price decreased a lot, especially for vegan burger, meatballs, yoghurts and so on*”, “*at the beginning of my diet, in 2020, I consumed those products once per month because of the price, but now I consume them at least once per week*” and “*at the beginning there was almost no variety, and many burgers were not so good. . . now it is completely different*”.

In conclusion, if from one side the presence on the shelves of plant-based products increased overtime, facilitating the adoption of a vegetarian and vegan diet, from the other side, an insufficient availability of these products is still experienced in small supermarkets, especially by those students living outside large cities [124].

Again, the question “If you were to host other vegetarian or vegan friends, would you prepare a ready-made plant-based food or something from scratch?” was asked. As expected, this situation is not new to participants, since they claim to have vegetarian and vegan friends and to organize or participate to this type of dinners. According to their answers, most students prefer cooking home-made dishes, such as “*vegetable lasagna*”, “*vegetable parmigiana*” and many other recipes. However, they often combine the main course with ready-made plant-based foods. For instance, two participants affirm “*I usually buy soy strips as an appetizer, and then I serve a home-made vegetarian first course*” and “*I usually serve some vegetable spring rolls and falafels*”. Few students claim to occasionally organize themed dinners during which they only eat ready-made plant-based products. Lastly, other respondents intentionally purchase meat substitutes for their omnivorous friends, “*when I invite some non-vegetarian friends, I often make them taste particular foods, like Vuna (vegetarian tuna) or burgers similar to meat. I want to convince them that vegetarian products can be appetizing as well!*”. It is possible to conclude that the difficulty in cooking plant-based products perceived by omnivorous students belonging to the first group is not shared by the other two samples.

Lastly, to the question “Would you prefer to order a plant-based hamburger or a vegetarian/vegan dish at the restaurant?” seven respondents replied to

select the first choice. However, almost all of them claim that it is difficult to find restaurants offering those products, and for this reason they often opt for a vegetarian or vegan course. Indeed, the unavailability of meat alternatives experienced by consumers at the restaurant represents a great barrier to their consumption [122,143].

<b>Drivers</b>	Omnivorous plant-based refusers n=10	Omnivorous plant-based users n=10	Vegetarians plant-based users n=10
<b>Veggie burgers</b>	<ul style="list-style-type: none"> <li>-Curiosity</li> <li>-Health concerns</li> <li>-Vary the diet</li> <li>-Tasteful</li> <li>-Improved consumption of vegetables and legumes</li> <li>-Natural</li> </ul>	<ul style="list-style-type: none"> <li>-Greater knowledge</li> <li>-Curiosity</li> <li>-Tasteful</li> <li>-Health concerns</li> <li>-Environmental benefits</li> <li>-Familiarity</li> <li>-Less expensive than meat</li> <li>-Ease of preparation</li> <li>-Improved consumption of vegetables and legumes</li> </ul>	<ul style="list-style-type: none"> <li>-Greater knowledge</li> <li>-Familiarity</li> <li>-Variety</li> <li>-Tasteful</li> <li>-Dislike for meat</li> <li>-Health concerns</li> <li>-Environmental benefits</li> <li>-Ethical concerns</li> <li>-Natural and unprocessed</li> <li>-Ease of preparation</li> <li>Not expensive</li> </ul>
<b>Meat analogues</b>	<ul style="list-style-type: none"> <li>-Curiosity</li> </ul>	<ul style="list-style-type: none"> <li>-Greater knowledge</li> <li>-Curiosity</li> <li>-Tasteful</li> <li>-Ease of preparation</li> <li>-Environmental benefits</li> </ul>	<ul style="list-style-type: none"> <li>-Greater knowledge</li> <li>-Curiosity</li> <li>-Health concerns</li> <li>-Environmental benefits</li> <li>-Ethical concerns</li> <li>-Tasteful</li> <li>-Ease of preparation</li> </ul>

**Table 4.3:** Summary of the drivers facilitating the consumption of plant-based products according to participants (n=30).

**Source:** data gathered from interviews (n=30) carried out for the current research

<b>Barriers</b>	Omnivorous plant-based refusers n=10	Omnivorous plant-based users n=10	Vegetarians plant-based users n=10
<b>Veggie burgers</b>	<ul style="list-style-type: none"> <li>-Lack of knowledge</li> <li>-Culinary traditions and unfamiliarity</li> <li>-Not filling</li> <li>-Not enough proteins</li> <li>-Processed</li> <li>-Distasteful</li> <li>-Attitudinal</li> <li>-Lack of culinary knowledge</li> <li>-Expensive</li> </ul>	<ul style="list-style-type: none"> <li>-Distasteful</li> <li>-Unnatural and processed</li> </ul>	<ul style="list-style-type: none"> <li>-Unavailability in small shops</li> </ul>
<b>Meat analogues</b>	<ul style="list-style-type: none"> <li>-'Concept'</li> <li>-Lack of knowledge</li> <li>-Culinary traditions and unfamiliarity</li> <li>-Unhealthy</li> <li>-Distasteful</li> <li>-Distrust in food technologies</li> <li>-Lack of culinary knowledge</li> <li>-Expensive</li> <li>-Food neophobia</li> </ul>	<ul style="list-style-type: none"> <li>-Distasteful</li> <li>-Expensive</li> <li>-Unnatural and processed</li> <li>-Not so healthy</li> <li>-Heavy to digest</li> </ul>	<ul style="list-style-type: none"> <li>-Dislike for meat taste</li> <li>-Processed</li> <li>-Not so healthy</li> <li>-Heavy to digest</li> <li>-Expensive</li> <li>-Unavailability in small shops</li> </ul>

**Table 4.4:** Summary of the barriers limiting the consumption of plant-based products according to participants (n=30).

**Source:** data gathered from interviews (n=30) carried out for the current research

## 4.5 Laddering technique and Means-end chain analysis

### 4.5.1 Introduction

The third section of the qualitative research covers the laddering technique and the means-end chain analysis. As already discussed in Chapter 3, means-end chain analysis in combination with the laddering technique offer useful insights to study the relationship between food products and consumers [165]. Indeed, means-end chain theory represents a valuable tool to achieve the real values motivating consumer's choice at the moment of the purchase [163]. Consequently, due to its cognitive approach, it is a way to understand consumer behavior [165, 166].

To carry out the analysis, existing literatures was taken into consideration. The research conducted by the author Haas et al. (2019) [163], applying the laddering and means-end chain analysis to study the motivational structure of the consumption of plant-based milk and cow milk was considered as a reference point for the current study. The approach employed to generate the list of product attributes was the free elicitation technique. Laddering interviews should be further used to elicit the attributes, benefits, and values. Again, for the analysis, results were gathered in accordance with the division of participants in three groups corresponding to their dietary habits regarding plant-based food consumption. Additionally, since students have different perceptions of common plant-based products, as veggie burgers and meat analogues, different attributes, consequences, and values were obtained. For these reasons, a total of twelve hierarchical value maps are presented in the following pages namely for:

- Omnivorous not consuming plant-based products
- Omnivorous consuming plant-based products
- Vegetarians consuming plant-based products

To interpret data more clearly, the negative ladders were separated from the positive ones. Therefore, for each group, four hierarchical value maps were

constructed. The interviewees were first asked to list all the products attributes that come to their mind when thinking about a plant-based meat substitute. A comparison with meat was encouraged to obtain a general understanding of the perceived differences between the products. Lastly, especially for omnivorous not consuming plant-based, it seemed appropriate to further ask the possible motives leading vegetarian and vegan consumers to purchase plant-based food. The sets of questions generated a list of product attributes which were further examined with the laddering technique in order to achieve the values, that should be considered as high order outcomes or ends [165], with a high degree of abstraction [185]. To present more homogeneous data, Schwartz Theory of Basic Values was taken as a reference point. According to Schwartz (2012), ten basic individual values exist and are different according to the underlying goal of individuals [186–188]. The ten values [188] are:

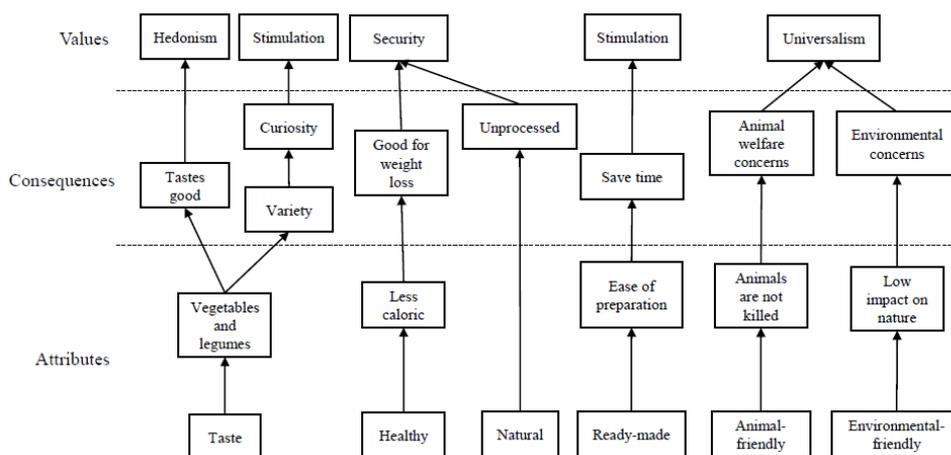
1. “Self-Direction – Defining goal: independent thought and action–choosing, creating, exploring.”
2. “Stimulation – Defining goal: excitement, novelty, and challenge in life.”
3. “Hedonism – Defining goal: pleasure or sensuous gratification for one-self.”
4. “Achievement – Defining goal: personal success through demonstrating competence according to social standards.”
5. “Power – Defining goal: social status and prestige, control or dominance over people and resources.”
6. “Security – Defining goal: safety, harmony, and stability of society, of relationships, and of self.”
7. “Conformity – Defining goal: restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.”
8. “Tradition – Defining goal: respect, commitment, and acceptance of the customs and ideas that one’s culture or religion provides.”

The outcomes of the analysis, representing the hierarchical value maps of the three groups, are displayed in Figure 4.1, Figure 4.2, Figure 4.3, Figure 4.4, Figure 4.5, Figure 4.6, Figure 4.7, Figure 4.8, Figure 4.9, Figure 4.10, Figure 4.11, Figure 4.12. These charts should be interpreted starting from the bottom, where all the product attributes are shown, rising upwards, where first the consequences and then the values of participants are reported. A cut-off level of 2 was employed to improve the readability of the hierarchical value maps.

To allow a better comparison of the twelve hierarchical value maps, results will be analysed as follow:

- Vegetarian burger
  - Drivers (Group A, B, C): Figure 4.1, Figure 4.2, Figure 4.3
  - Barriers (Group A, B, C): Figure 4.4, Figure 4.5, Figure 4.6
- Meat-imitation burger
  - Drivers (Group A, B, C): Figure 4.7, Figure 4.8, Figure 4.9
  - Barriers (Group A, B, C): Figure 4.10, Figure 4.11, Figure 4.12

## 4.5.2 Analysis of the positive ladders



**Figure 4.1:** Hierarchical value map of positive ladders for vegetarian burger according to omnivorous not consuming plant-based (Group A)

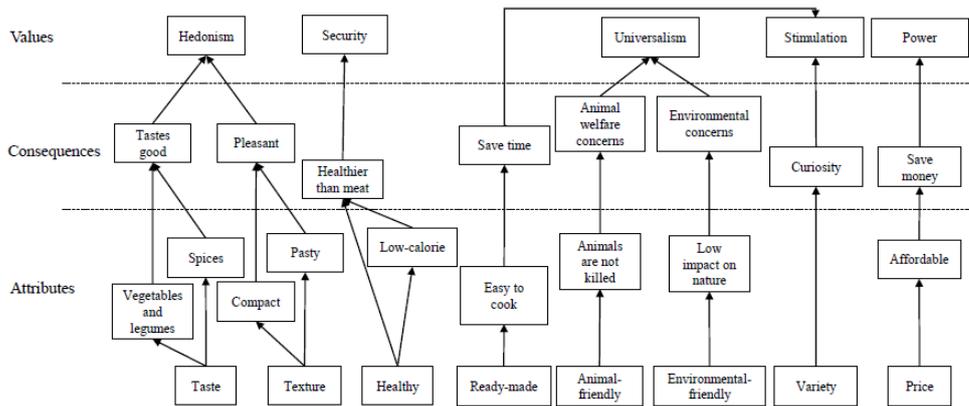
Figure 4.1 shows the HVM of positive ladders for vegetarian burger according to omnivorous students not consuming plant-based. This map contains eleven product attributes, eight consequences and five values. Several participants seem to appreciate the taste of veggie burgers containing their favourite vegetables and legumes. Therefore, the consequence “tastes good” is defined, and it is linked to the value “hedonism”, that indicates the pleasure derived from the consumption of an indulgent food. Some students reported that the “variety” of combinations of ingredients used to produce veggie burgers is an element improving their “curiosity” and leading towards the value “stimulation”. This value is linked to the need to vary the diet and to maintain a certain level of activation and novelty in life. In line with the previous results, veggie burgers provide a tasty alternative to regular vegetables and legumes which could attract omnivorous consumers. However, an increased consumption of veggie burgers is not likely to limit the consumption of conventional meat among omnivorous.

Contrarily, vegetarians and vegans, together with meat-reducers often consider plant-based substitutes a good alternative to meat. Veggie burgers are described as a “healthy option” because of the lower content of calories contained; this attribute is important for omnivorous because it gives them the feeling of being in control of how many calories they assume. The consequence is that veggie burgers are considered “good for weight loss”, giving them the feeling of a healthier lifestyle. Therefore, the connection to the universal value “security” is created, as it expresses the goal of security for self, so it is related to wellness and health-related concerns. Similar considerations are made for the attribute “natural” that is linked to the consequence “unprocessed” and to the value “security”.

Veggie burgers are described as “ready-made” products, leading to the functional consequence that these foods are easy to cook. During the interviews, it appeared evident that for most participants cooking is considered boring and sometimes an obligation rather than a choice. For these reasons, the value “stimulation” is achieved, meaning that cooking vegetarian burgers could give the possibility to focus on more stimulating and challenging activities.

Throughout the interviews, the value “universalism” emerged. According

to the author Schwartz (2012) [187], this value implies the willingness of people to protect the environment and nature as a way to reach inner harmony. Indeed, most students describe plant-based alternatives as environmental and animal friendly since these products have a lower impact on nature and do not include killing animals. However, it is fundamental to mention that these aspects are not significantly considered by students belonging to the first group (omnivorous not consuming plant-based), in fact animal-welfare concerns do not actually limit the consumption of meat. As a matter of fact, participants are aware of the current challenges related to environmental sustainability, and they consider plant-based products a possible way to reduce those issues.



**Figure 4.2:** Hierarchical value map of positive ladders for vegetarian burger according to omnivorous consuming plant-based (Group B)

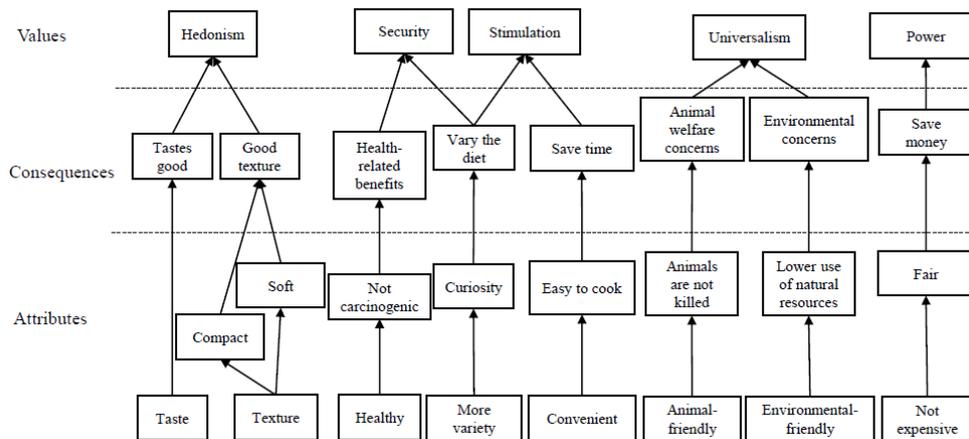
In Figure 4.2 the hierarchical value map of the positive ladders for veggie burger is reported, according to the considerations of Group B, namely students following an omnivorous diet including the consumption of plant-based foods. Within this HVM there are seventeen attributes, eight consequences and five values. Compared to the previous group, certain attributes are recurring. As for “taste”, the attribute “spices” is cited by few students claiming that veggie burgers are often rich in spices. “Texture” is linked to the attributes “compact” and “pasty”, leading to the consequence “pleasant” and to the value “hedonism”.

One of the most important attributes is “health”. According to the second group, plant-based items are perceived as a healthier option to meat, leading

to the universal value “security”. Therefore, a healthy living represents a way to feel physically and psychologically fulfilled. Similarly to the first group, few students show interest in keeping the amount of calories under control, because the attribute “low-calorie” emerged. However, a different perception between the omnivorous samples appears evident. In the first group, veggie burgers are not always believed healthier than meat, while in the second, students claim to consume those products to reduce the consumption of meat, which was previously described detrimental for health. In conclusion it is possible to state that a healthy living is a goal shared by several participants, and veggie burgers could represent a means to this end.

Within this HVM, the dominant value is “universalism”: according to Schwartz (2012) [187], this value derives from survival needs of both individuals and groups, and people recognize these needs only when they become aware of the scarcity of natural resources. Therefore, participants caring to protect nature and its limited resources are those who appear to be more environmentally conscious. Indeed, the choice of consuming plant-based food is directly linked to the need of protecting the environment and to respect the welfare of nature. Even among meat-reducers, animal-welfare concerns are less significant, even though are still recognized.

The novel feature “price” emerged in the second group. However, only few students perceive the price of plant-based foods “affordable”, especially when compared to meat. This positive attribute encourages the purchase of veggie burgers, since it represents a way to “save money”, reaching the universal value “power”. According to the author (Schwartz, 2012), this value reflects the need of individuals for dominance and control over resources and people. Therefore, being able to afford to buy “niche products” expresses a status symbol.



**Figure 4.3:** Hierarchical value map of positive ladders for vegetarian burger according to vegetarians consuming plant-based (Group C)

Figure 4.3 shows the HVM of positive ladders for vegetarian burger according to the last group, comprehending vegetarian and vegan students. Sixteen product attributes, eight consequences and five values compose the map.

As for the other two samples, the value “hedonism” is present. However, during the interviews vegetarian and vegan consumers showed a greater appreciation for the taste and texture of veggie burgers, especially when compared to omnivorous not consuming plant-based alternatives. Therefore, the consumption of vegetarian burgers is associated to pleasure and indulgence, and it could be seen by several students belonging to the third group as a comfort food. Indeed, the gratification deriving from eating certain foods could be one of the reasons to better enjoy life.

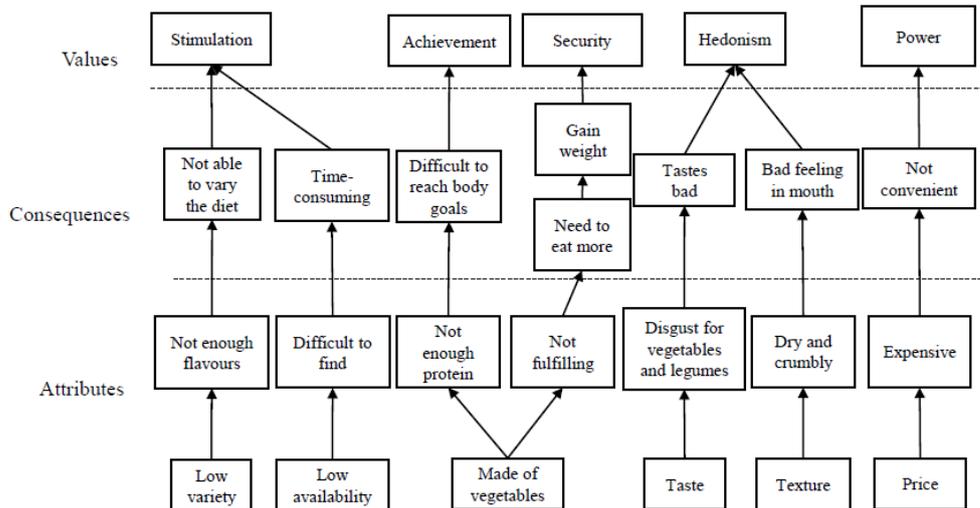
The two dominant universal values are “security” and “universalism”. The concept of following a healthy lifestyle that was already pointed out in previous groups is more prominent among vegetarian and vegan people. Indeed, several students decided to switch to a vegetarian diet for health reasons, implying that meat is “carcinogenic” and therefore the consumption of veggie burgers is justified by safety reasons. However, contrary to the other samples, it should be noticed that the vegetarian and vegan sample does not necessarily believe that plant-based burgers are low in calories. The value of “universalism” is more deeply felt by the third group. Especially when considering animal-welfare, they seem to truly care about this thematic, showing great compassion towards

nature and animals. As reported in the previous sections of the analysis, the main reasons justifying the changes in dietary habits are to be found in environmental, ethical, and health-related concerns.

The attribute “variety” is mentioned. Indeed, students who mostly consume only vegetarian alternatives are more likely to have a better knowledge regarding their availability and variety. The functional consequence is that a wider variety of products could lead to arouse curiosity in consumers, who will probably be more tempted to purchase several burgers of different brands. Therefore, the wider presence on shelves of plant-based burgers is helpful to “vary the diet”. This consequence is both linked to the values of “security” and “stimulation”. On one side, eating a varied diet is believed to be beneficial for health, on the other it contributes to the need for stimulation by preserving an exciting and challenging life.

Again, the attribute “convenient” emerged and it is related to the opinion that veggie burgers are practical and easy to cook. This leads to the consequence “save time” that implies the possibility of people to pursue other interests rather than cooking. Therefore, the universal value “stimulation” is reached. Lastly, several students share the opinion that veggie burgers are “not expensive”. Contrary to meat, which is sometimes sold at excessively low prices due to intensive production and breeding systems, the price of plant-based foods is “fair”.

### 4.5.3 Analysis of the negative ladders for vegetarian burgers



**Figure 4.4:** Hierarchical value map of negative ladders for vegetarian burger according to omnivorous not consuming plant-based (Group A)

Figure 4.4, showing the hierarchical value map of negative ladders for a vegetarian burger according to omnivorous not consuming plant-based, is composed by thirteen attributes, eight consequences and five values. As already mentioned in the previous section, tastes are subjective, therefore the likeability for peculiar ingredients – vegetables, cereals, legumes – strongly depends upon consumer’s personal preferences. For this reason, the “taste” of specific veggie burgers is reported by few participants as a negative attribute due to the presence of distasteful vegetables and legumes, leading to the consequence of “tastes bad” and to the value “hedonism”. The same could be implied for the attribute “texture” and “dry and crumbly”, which are used as negative connotations.

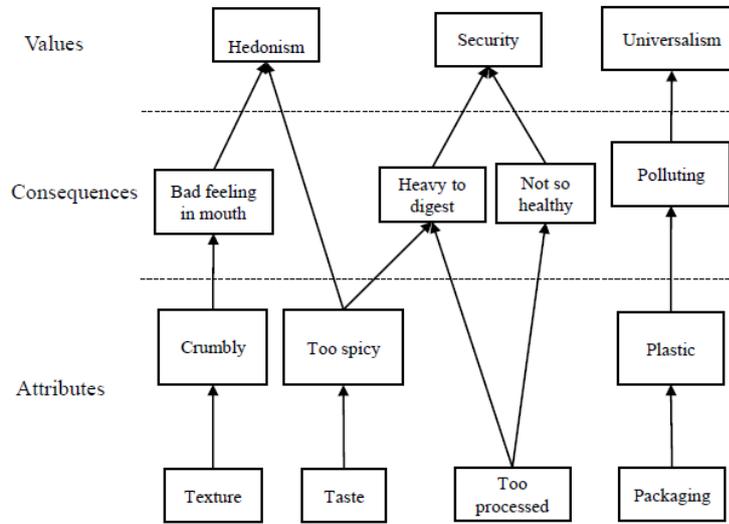
Another negative attribute is “made of vegetables”. According to few students, as the primary ingredients are vegetables, veggie burgers often lack in proteins. Based on their perception, since higher amount of proteins are needed to build up muscles, individuals who do not follow a protein diet are not able to reach certain body goals. Therefore, a lack of confidence could be experienced since they do not feel attractive to others. This leads to the value “achievement” indicating the need for social approval which is not satisfied.

The feature “made of vegetables” is also linked to the attribute “not fulfilling”, leading to the practical consequence “need to eat more”. The psychological consequence is that eating more food could result with an excessive calories intake, and so to “gain weight”. Not being in control of how many calories they assume give them the feeling of following an unhealthy lifestyle, leading to the value “security”.

Few omnivorous students complain about the “low variety” of plant-based alternatives, as “not enough flavours” are present on the shelves of the supermarkets. This leads to the consequence “not able to vary the diet” and to the universal value “stimulation”. The perceived difficulty of varying the diet demonstrates how participants are involved in keeping a healthy lifestyle as a way to feel good about themselves.

Similarly, few people claim that plant-based foods are scarcely available and difficult to find in supermarkets. This could be attributed to the fact that in small shops outside large cities it may be difficult to find peculiar plant-based products. As a consequence, looking for these foods appears to be “time-consuming”. Indeed, throughout the interviews most omnivorous claimed to not take care of grocery shopping, concluding that this task is primarily carried out by their parents. The value “stimulation” is reached, because participants perceive this task as a waste of time which could be exploited to perform more engaging and exciting activities.

Within this group, “power” is a dominant value. Almost all students perceive plant-based food as “expensive”, especially when compared to meat, which is more affordable. The functional consequence is that veggie burgers are “not convenient”, leading to the impossibility of saving money and a negative impact on family budget. Moreover, the consideration that a vegetarian burger is a niche product implies that people with budget restraints feel economically inferior to others and are excluded by higher social groups. This explains the value “power”, meaning that individuals are not socially recognized, and they cannot impose dominance over resources or other people.



**Figure 4.5:** Hierarchical value map of negative ladders for vegetarian burger according to omnivorous consuming plant-based (Group B)

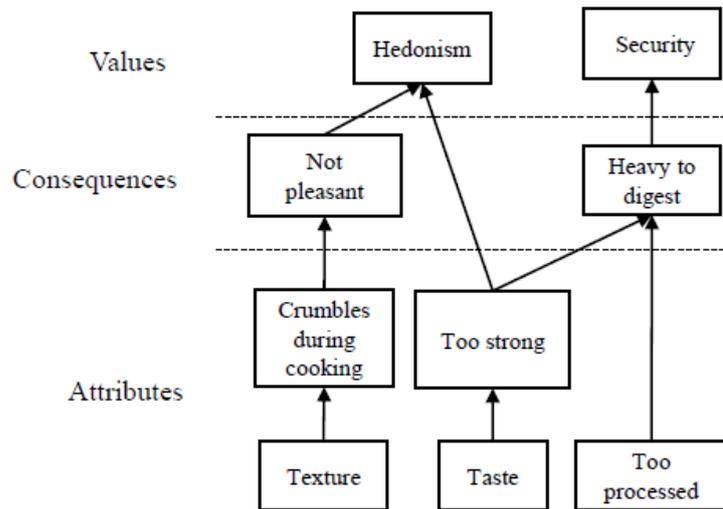
The HVM of negative ladders for a vegetarian burger according to the opinions of participants belonging to the second group is shown in Figure 4.5. The map includes seven attributes, four consequences and three values. By looking at the structure of the map it is possible to appreciate a difference compared to the previous sample. Fewer negative attributes are named, therefore a general positive perception of consumers towards veggie burgers is considerable.

Few participants describe the texture of vegetarian burgers “crumbly”, and this feature results giving a “bad feeling in mouth”. Moreover, plant-based burgers are often associated to the negative attribute “too spicy”, leading to the shared value “hedonism”, indicating a lack of pleasure and enjoyment.

However, according to some students, veggie burgers that are “too spicy” appear to be “heavy to digest”. What results is a physical discomfort that could actually deters the purchase of veggie burgers. The value “security” is obtained since these products could have some negative impacts on the health of individuals. The universal value “security” is also connected to the consequence “not so healthy” since these products are considered by some students as “too processed”.

Lastly, few participants claim that the “packaging” of veggie burgers is often made with “plastic”, and consequently it is “polluting” for the environment. A remarkable interest in the environmental theme is shown. There-

fore, the value “lack of universalism” is reached, because purchasing non-eco-friendly packages could be harmful for nature.

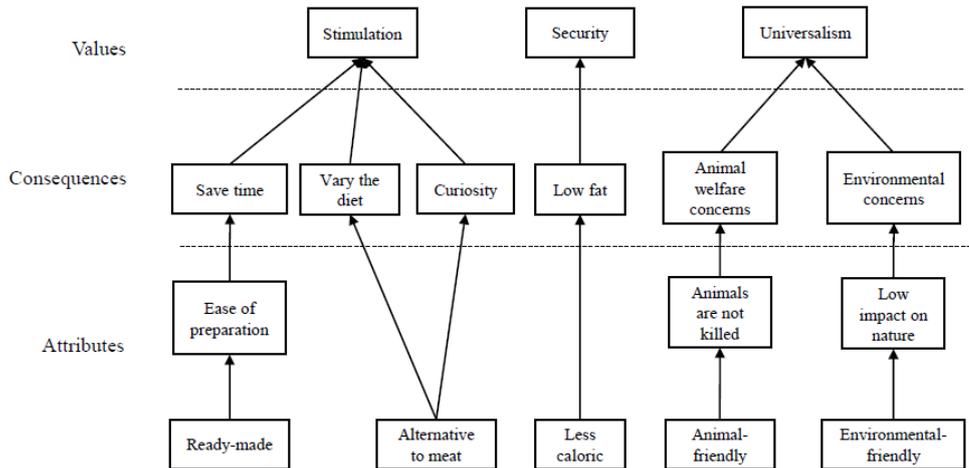


**Figure 4.6:** Hierarchical value map of negative ladders for vegetarian burger according to vegetarians consuming plant-based (Group C)

In Figure 4.6, the HVM shows five attributes, two consequences and two values associated to the negative ladders for vegetarian burgers according to vegetarian and vegan participants. Compared to the other groups, a very limited number of features emerged, since students expressed a remarked likeability for plant-based foods, which are the basis of their diets. Moreover, very similar considerations to the second sample are made.

What is perceived negative by few interviewees are the “texture” and the “taste”, that are described as crumbly and too strong. The value “hedonism” implies the lack of indulgence derived by eating certain veggie burgers. Again, few students consider plant-based burgers “too processed”, claiming to have experienced difficulty in digesting certain typologies of veggie burgers, leading to the lack of “security”.

#### 4.5.4 Analysis of the positive ladders for imitation meat burgers

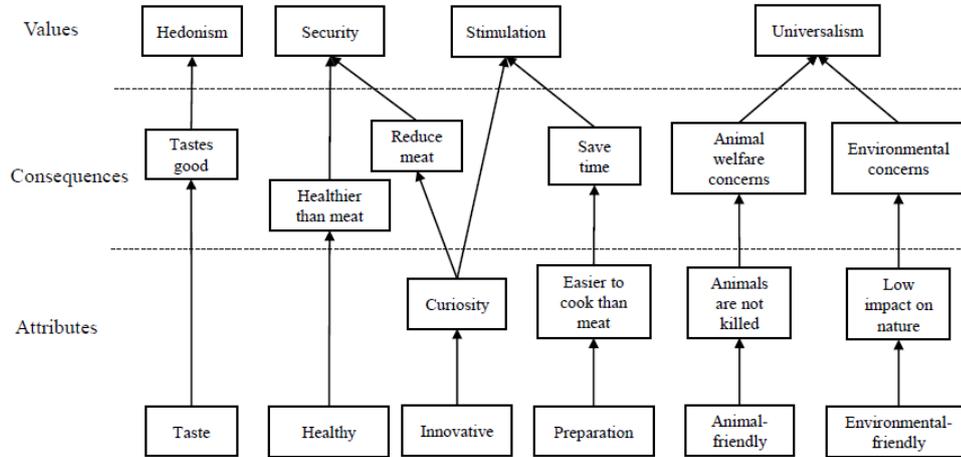


**Figure 4.7:** Hierarchical value map of positive ladders for imitation meat burger according to omnivorous not consuming plant-based (Group A)

In Figure 4.7, the HVM of positive ladders for meat analogue burger is shown. Participants belonging to Group A – omnivorous not consuming meat alternatives – identified eight attributes, six consequences, and three values. It should be noted that this meatless burger was only tasted by four students out of ten. Therefore, the result of the analysis also includes the expectations of those consumers who have never tried this food. This could explain the lower number of features compared to the HVM of the veggie burger (Figure 4.1).

Since it is a plant-based burger, most of the attributes have been already cited for the vegetarian counterpart, and similar explanations were given by respondents. This applies for the features “ready-made”, “less caloric”, “animal-friendly” and “environmental-friendly”.

However, students believe that the imitation meat burger is supposed to represent an “alternative” to conventional meat, since the flavour, taste, appearance, texture and nutritional properties should resemble meat. As a consequence, “curiosity” arises in several consumers, leading to the universal value “stimulation”, defined as the need of individuals to behave as daring, and to apportion novelty and thrill to life. Similar considerations apply to the consequence “vary the diet”.



**Figure 4.8:** Hierarchical value map of positive ladders for imitation meat burger according to omnivorous consuming plant-based (Group B)

Within the HVM of positive ladders for the faux meat burger, omnivorous participants regularly consuming plant-based products defined ten product attributes, six consequences and four values (Figure 4.8).

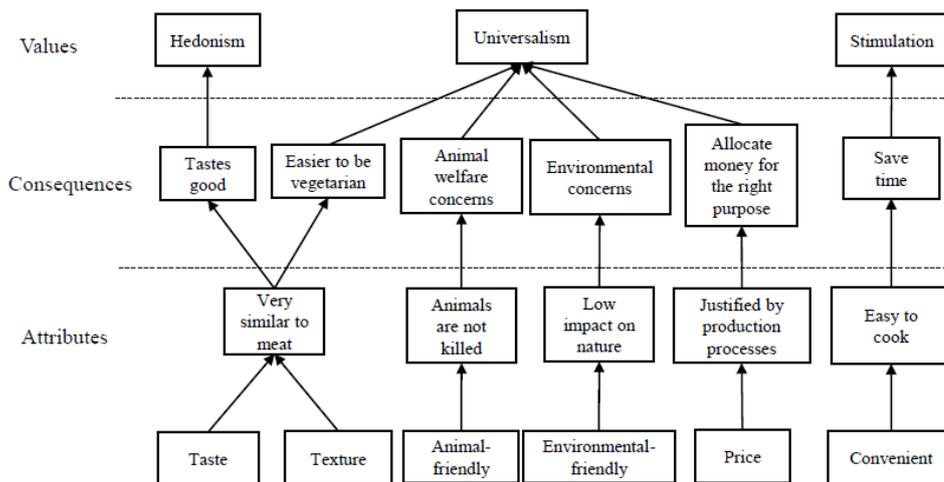
All ten students claim to have eaten at least once in their life a product resembling meat; therefore, the results obtained are based on experience, unlike the previous group. The attribute “taste” is mentioned for the first time. According to several participants, the meatless burger often “tastes good”, leading to the value of “indulgence”. Therefore, the universal value “hedonism” is achieved, that is linked to the feeling of pleasure associated with satisfaction. Few students describe the fake meat burger “healthy”, connected to the consequence “healthier than meat”. Hence, the positive ladders of wellness and health-oriented diet are obtained, leading to the universal value “security”.

Similarly to the previous group, this meat analogue is defined as “innovative”, thus creating “curiosity” in consumers. These new meat alternatives facilitate the reduction in meat consumption, which is considered bad for health, leading to the values of wellness and healthy lifestyle, and to the universal value “security”. According to the author Schwartz (2012), some values of security aim at providing primary needs of individuals, including the health-related aspect.

As in the previous group, the ease of preparation applies to both veggie

burgers and burger resembling meat. However, students belonging to Group B consider meat alternatives “easier to cook than meat”, because they do not require complex and longer preparation as meat. For instance, by cooking meatless burger it is possible to save time that could be devoted to something else. The values “flexibility” and “convenience” are reached, leading to the universal value “stimulation”.

Again, the environmental and ethical ladders followed the ladder “environmentally -friendly” and “animal-friendly” to the attribute “low impact on nature” and “animals are not killed”. The consequences are “environmental concerns” and “animal welfare concerns” leading to the dominant value “universalism”.



**Figure 4.9:** Hierarchical value map of positive ladders for imitation meat burger according to vegetarians consuming plant-based (Group C)

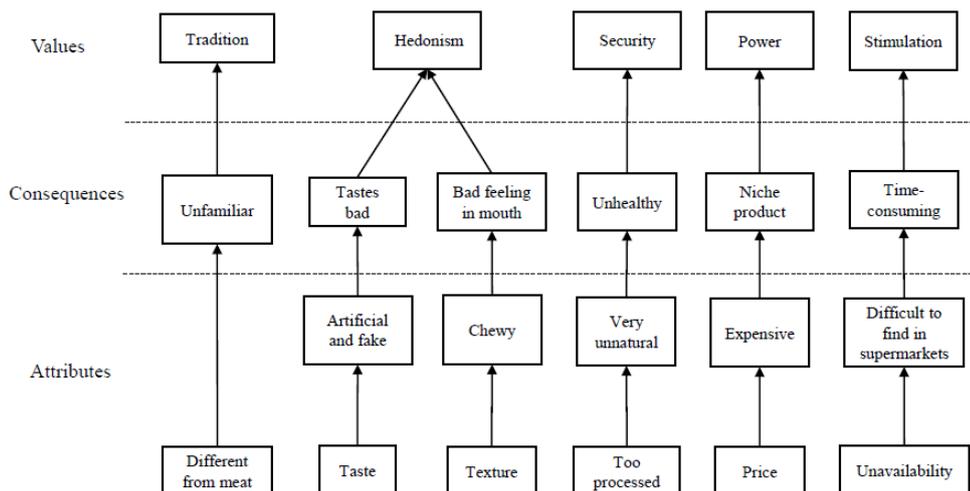
The HVM reported in Figure 4.9 shows eleven product attributes, six consequences and three values. As in the previous group, all participants have eaten at least once in life a plant-based burger resembling meat. However, few differences may be noticed.

According to some vegetarians and vegans, the attributes “taste” and “texture” are linked to “very similar to meat” and to the consequence “tastes good”. Therefore, the original taste and texture of meat is missed by some vegetarian and vegan consumers who are looking for products able to mimic

those attributes. The universal value is “hedonism”, indicating the indulgence and pleasure derived from the consumption of a product with the same characteristics of meat but without the negative effects on health, environment, and animal welfare typical of animal products.

At the same time, thanks to the creation of the novel PBMA, it became “easier to be vegetarian”, leading to the value “universalism”, since the act of switching diet is considered by several participants an act to protect nature. As previously assessed, the value “universalism” is followed by “animal-welfare concerns” and “environmental concerns”. Nevertheless, this influential value is indirectly connected to the attribute “price”. Differently from veggie burgers, the price of meat alternatives is not considered inexpensive, but rather it is defined as “justified by the production processes”. Indeed, several interviewees appear to be aware of the food technologies used for manufacturing the novel generation PBMA. This gives them the perception to “allocate money for the right purpose”, contributing to the welfare of nature, reaching the value “universalism”.

#### 4.5.5 Analysis of the negative ladders for imitation meat burgers



**Figure 4.10:** Hierarchical value map of negative ladders for imitation meat burger according to omnivorous not consuming plant-based (Group A)

The HVM of the negative ladders associated to the novel generation plant-based burger shown in Figure 4.10, is obtained by eleven product attributes, six consequences and five values.

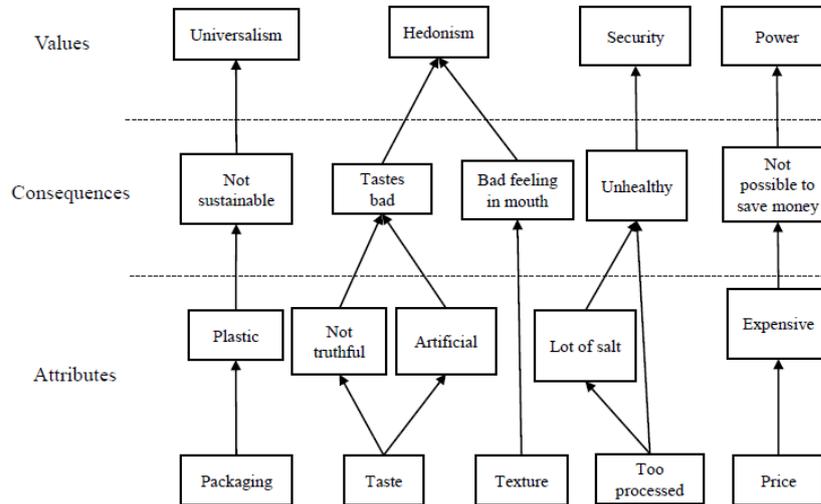
What emerged is the perceived unfamiliarity of this novel food. This meatless burger is described as too “different from meat”, leading to the consequence “unfamiliar”. As discussed in the previous sections, familiarity and traditionality play a key role in the consumption of plant-based meat alternatives, representing a barrier to these foods, especially for the first group of participants. Therefore, the universal value “tradition” is reached, since eating this type of food is not part of the Italian culture and moreover, social norms including the consumption of meat are not respected. “Taste” and “texture” are negatively described as “artificial and fake” and “chewy”, leading to the consequences “tastes bad” and “bad feeling in mouth”. The universal value “hedonism” implies the disgust and lack of appreciation related to eating a faux meat burger.

Several students share the belief that meat analogues are “too processed”, describing them as “very unnatural”. Industrial foods, in opposition to artisanal or home-made food, are often considered “unhealthy” by many consumers due to the presence of preservatives and additives and the lack of nutrients. As previously assessed, following a healthy lifestyle is of primary importance for several participants. Therefore, the ladder “lack of wellness” leads to the universal value “security”.

Novel generation PBMA burgers are considered more “expensive” when compared to meat and veggie burgers, leading to the consequence that this unfamiliar food is a “niche product”. This results in a feeling of powerlessness deriving from the difficulty in buying this food due to its higher price. Therefore, the universal value “power” describes the sensation of feeling inferior to others and to resources.

Lastly, few interviewees indicate the “low availability” of this type of food in the shelves of supermarket. Again, this could be explained by the fact that the fake meat burger is rather recent, especially when compared to other vegetarian products, including veggie burgers. Moreover, the availability is strongly influenced by the supermarket chain and the location of the grocery store. The consequence is that participants perceive the purchase as “time-

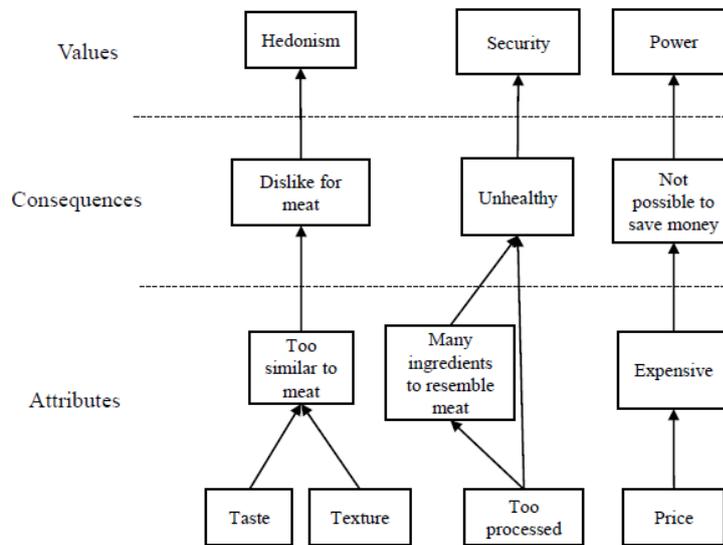
consuming” leading to the value “stimulation”, since the time lost to look for plant-based burgers could be used for more entertaining purposes.



**Figure 4.11:** Hierarchical value map of negative ladders for imitation meat burger according to omnivorous consuming plant-based (Group B)

Figure 4.11 illustrates the HVM of the negative ladders for the meatless burger, and it includes twelve product attributes, six consequences and five values. In accordance with the previous group, some attributes are repeated. It is the case of “taste”, described as “artificial”, leading to the negative ladder “tastes bad” and to the value “no hedonism”. However, the taste is also defined as “not truthful”. It should be remembered that participants of Group B are omnivorous who alternate the consumption of meat and plant-based meat alternatives.

Therefore, they are likely to better distinguish the real taste of meat, unlike many vegetarians and vegans who haven’t eaten meat for years. This could explain the discrepancy between the attribute “not truthful” presented in Figure 4.11 and the feature “very similar to meat” used by vegetarians and vegans in Figure 4.10.



**Figure 4.12:** Hierarchical value map of negative ladders for imitation meat burger according to vegetarians consuming plant-based (Group C)

Figure 4.12 displays the HVM of the negative ladders described by vegetarian and vegan consumers regarding meat analogues. The figure represents seven attributes, three consequences and three values.

The main difference compared to the previous groups concerns the attributes “taste” and “texture”, which are described as “too similar to meat”. As discussed in the previous paragraph, several vegetarians and vegans do not appreciate the taste and texture of meat, therefore they are going to dislike every product resembling it, including the novel generation PBMA. However, this opinion is not shared by all students, who are actually looking for meat alternatives (Figure 4.9). Hence, the feature “too similar to meat” is linked to the consequence “dislike for meat” and to the universal value “hedonism”.

Again, the value “security” is expressed by this group, which is linked to the ladder “unhealthy”. This belief rises from the opinion that this type of product is “too processed” because “many ingredients to resemble meat” are used for its manufacture. Even if according to some students, the price of the meat analogues is justified by technical reasons, the general opinion is that these products are still “expensive”, especially when compared to the most common veggie burgers. Therefore, the value “power” is experienced since it may seem difficult to save money by purchasing those products.

## 4.6 Picture-sorting technique

### 4.6.1 Introduction

As mentioned in Chapter 3, closed picture-sorting technique was carried out at the end of the interview.

The aim of this methodology is to explore how individuals mentally categorize specific concepts, so to understand the implicit associations with plant-based foods. Picture-sorting is useful to gathered information of how the beliefs of consumers are associated to their food and dietary choices and how they could influence the moment of purchase. The goal is to obtain insightful perspectives of consumers which could be further exploited by companies marketing plant-based foods.

Thirty images were selected for this task according to a specified criterion (Appendix). Two pictures depicting the two main categories are arranged on the table: one portrays a plant-based burger and the other a meat burger. It is further explained that these images serve to distinguish vegetarians and vegans only consuming plant-based food and omnivorous only eating meat. After that, participants are individually provided with a deck of thirty shuffled cards, faced down. One by one, they are asked to turn the image and to arrange the picture in the two categories. When the interviewee organises the card, he is asked to give a brief explanation of what motivated him to choose that category. The analysis and discussion of the results is carried out following the division of participants into three groups, according to their dietary habits. This could provide interesting information to plant-based brands, which could organize marketing strategies according to different targets of consumers.

Three graphs are obtained – Graph 4.13, Graph 4.14, and Graph 4.15 – showing the results of the picture-sorting technique for Group A, Group B and Group C respectively. The charts display on the x-axes the image index, meaning that each number corresponds to an image (Appendix), while on the y-axes, the number of interviewees ( $n=10$ ) belonging to a group. Precisely, the graphs present in *green* the number of respondents associating the image to plant-based products, and in *red* the number of participants correlating the image to meat burgers.

After having classified each image into two groups, participants provided a

brief explanation justifying their decision. To visually summarize interviewees' words, "tag clouds" or "word clouds" were selected.

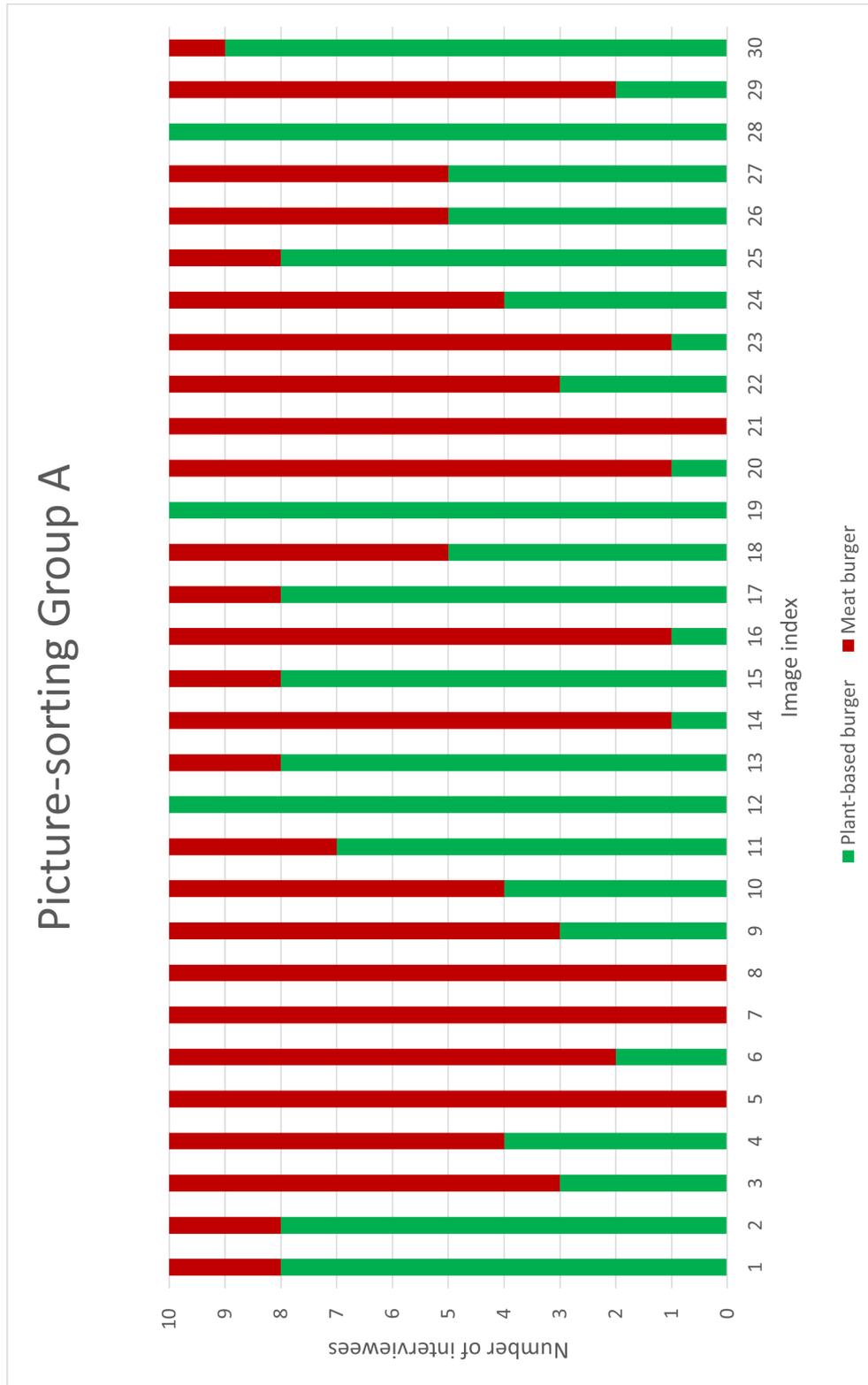
A word cloud is a cluster of words displayed in different dimensions, based on the frequency according to which certain words are quoted. Therefore, the bigger are the words, the more they were cited [189, 190]. To simplify the visualization of the results, some words used only once by participants were collected in a single term with the same meaning. For example, in Image 1, the word "flower" was cited by one participant out of ten and was therefore included in the term "nature".

On the following pages, six word clouds are displayed namely for:

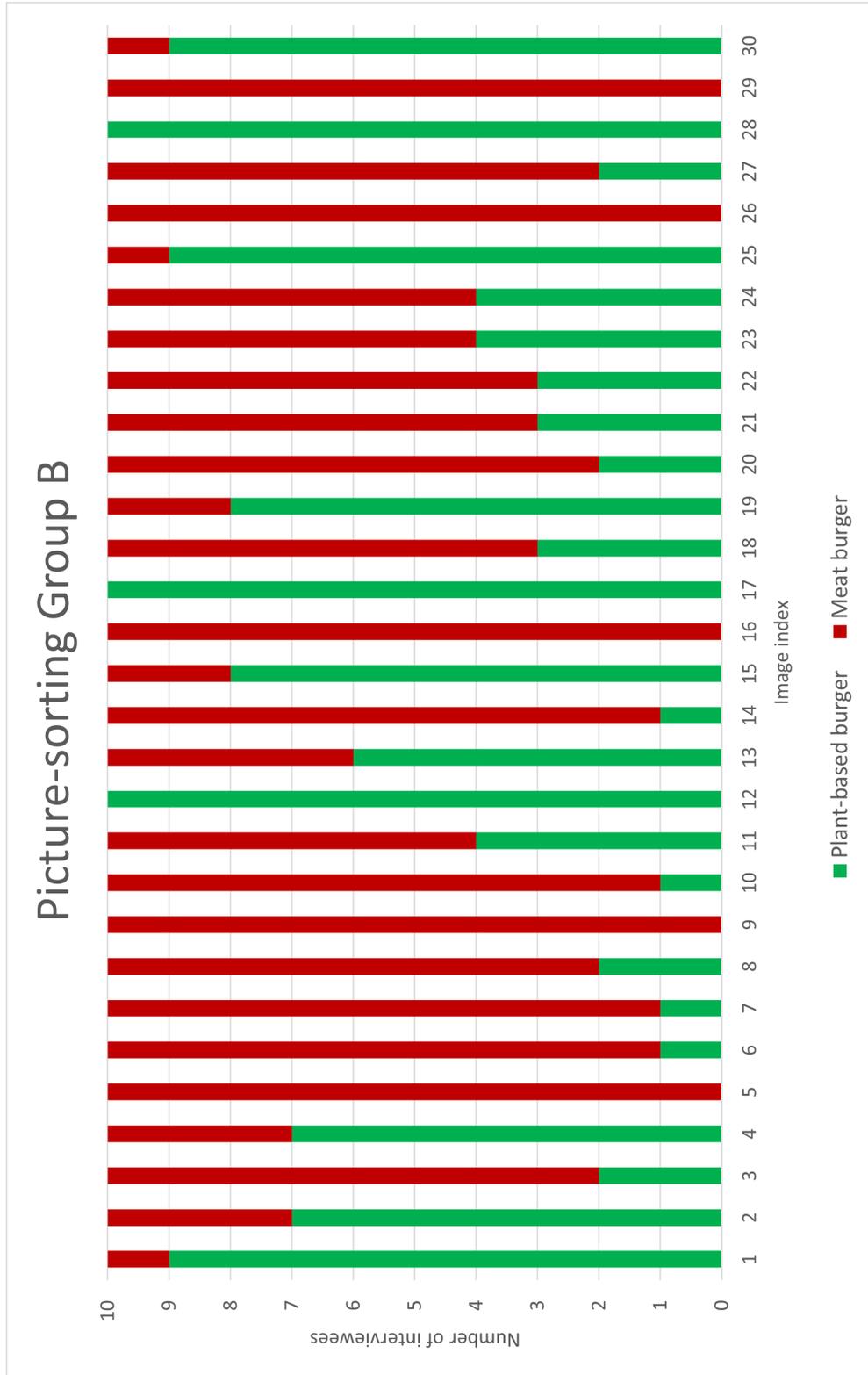
- Group A: omnivorous not consuming plant-based food
  - Plant-based burger word cloud (Figure 4.16)
  - Meat burger word cloud (Figure 4.17)
- Group B: omnivorous consuming plant-based
  - Plant-based burger word cloud (Figure 4.18)
  - Meat burger word cloud (Figure 4.19)
- Group C: vegetarians consuming plant-based
  - Plant-based burger word cloud (Figure 4.20)
  - Meat burger word cloud (Figure 4.21)



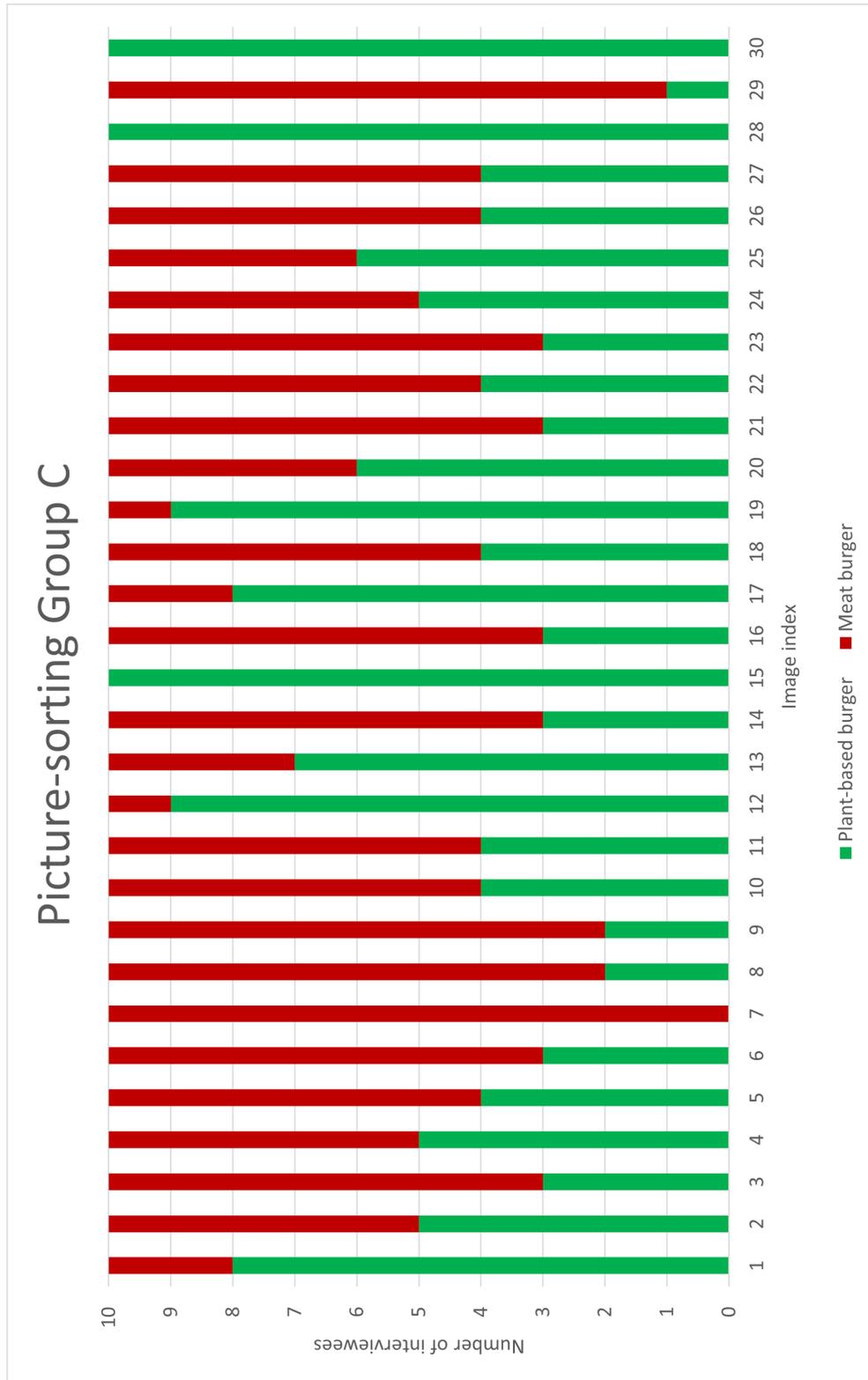
### 4.6.2 Results and discussion of Picture-sorting technique



**Figure 4.13:** Graph of picture-sorting results of omnivorous students not consuming plant-based products. On the x-axis the image index is reported (n=30), while on the y-axis the number of interviewees (n=10)



**Figure 4.14:** Graph of picture-sorting results of omnivorous students consuming plant-based products. On the x-axes the image index is reported (n=30), while on the y-axes the number of interviewees (n=10)



**Figure 4.15:** Graph of picture-sorting results of vegetarian students consuming plant-based products. On the x-axes the image index is reported (n=30), while on the y-axes the number of interviewees (n=10)



**Figure 4.16:** Word cloud for plant-based burger category according to omnivorous not consuming plant-based food (Group A)



**Figure 4.17:** Word cloud for meat burger category according to omnivorous not consuming plant-based food (Group A)



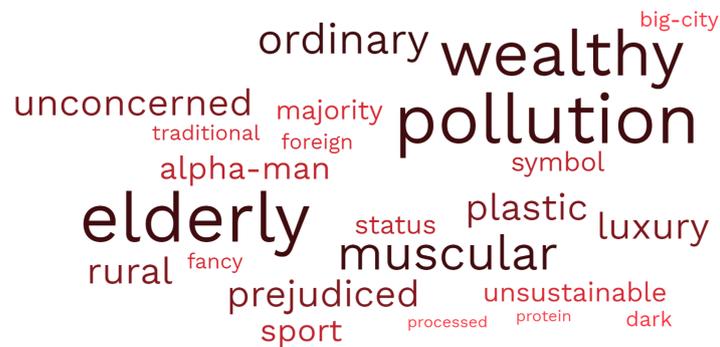
**Figure 4.18:** Word cloud for plant-based burger category according to omnivorous consuming plant-based food (Group B)



**Figure 4.19:** Word cloud for meat burger category according to omnivorous consuming plant-based food (Group B)



**Figure 4.20:** Word cloud for plant-based burger category according to vegetarians consuming plant-based food (Group C)



**Figure 4.21:** Word cloud for meat burger category according to vegetarians consuming plant-based food (Group C)

By analysing the images, the following results could be discussed. The most recurring terms used for describing plant-based products focus on sustainability and health topics, suggesting that almost all participants consider plant-based

products beneficial for both environment and health, while meat is often associated to pollution, plastic, and unsustainability. In accordance with the previous findings, it should be concluded that all three samples of consumers are aware of the negative impacts of meat related to environment, health, and animals. However, the three groups display different involvements towards these themes. For instance, meat-reducers belonging to the second group are particularly concerned about environmental aspects, while vegetarians and vegans express strong interest in the topic of animal-welfare.

Considering omnivorous not consuming plant-based, they do not express a marked sensitivity as the other groups. Nevertheless, by observing Figure 4.16, it should be concluded that environmental and health-related topics could represent potential drivers for the consumption of plant-based food. At the same time, it is important to further discuss the health issue, since it has two different meanings depending on segments of consumers. As highlighted by the means-end chain analysis, omnivores often associate plant-based food to a diet suitable for losing weight, therefore justifying the term “slim” in Figure 4.16. On the contrary, the belief that vegetarian alternatives contribute to weight loss is not shared by the sample of vegetarians and vegans, which consider eating plant-based part of a healthy diet and lifestyle. Regarding animal-welfare, as already mentioned, this is particularly important for vegetarians and vegans rather than omnivorous. In accordance with the previous findings, animal-welfare acts as a facilitator for the consumption of plant-based food for consumers following a vegetarian diet, and in part for those consumers trying to reduce meat, while for omnivorous students this attribute is irrelevant.

In conclusion, to attract a wider range of consumers, including meat-eaters, specific information regarding the environmental and health benefits of plant-based meat should be stressed.

Meat alternatives are described by almost all participants “alternative” foods. However, the term gathers different connotations among groups. Omnivorous students perceive plant-based products unfamiliar and out of the ordinary, while meat is often an expression of the culinary-traditions, as it is described a traditional and familiar food. Although to a lesser extent, this belief is often shared by meat-reducers. Consequently, in line with the previous find-

ings, the unfamiliarity linked to the consumption of plant-based alternatives is a fundamental barrier limiting their consumption among omnivorous. On the contrary, the group of vegetarians and vegans expressed the term “familiar” in relation to meat substitutes, suggesting that these products are considered integral part of their diet. Consequently, familiarity and traditionality linked to plant-based alternatives act as a driver for vegetarian and vegan consumers.

Another difference refers to the term “sport”, “muscular”, and “athlete”. Among the three groups, these words are usually associated to meat (Figure 4.17, Figure 4.19, Figure 4.21). Nevertheless, these labels appear in Figure 4.20, suggesting that vegetarian and vegan consumers consider plant-based foods able to provide the necessary nutrients to support physical efforts, including sports. This opinion is in contrast with the perception of omnivorous consumers believing that meat analogues and vegetarian products do not contain enough proteins and are not satiating, suggesting that the consumption of conventional meat should be preferred to gain muscles and to improve physical performance.

# Chapter 5

## Conclusions, Limitations, and Recommendations

### 5.1 Conclusions

The purpose of this study was to explore the drivers and barriers acting as facilitators and demotivators for the consumption of plant-based foods, focusing on veggie burgers and meat analogues, and how these vary among consumers according to different dietary habits. The qualitative approach as data collection method was employed, and a total of thirty in-depth interviews were carried out for a sample of participants following three distinct dietary patterns. To further explore the real values and the implicit associations related to the perception of plant-based products, laddering interviews through the means-end chain analysis and the picture-sorting technique were applied. This research, considered jointly with existent literature, could contribute to the generation of insightful information useful for companies commercialising plant-based products.

#### 5.1.1 Revising research questions

In accordance with the data gathered through the interviews, it should be concluded that the drivers and barriers for the consumption of plant-based products largely depends on individuals dietary habits.

Among omnivorous not consuming plant-based products, there is a general

positive opinion of veggie burgers. Being made of vegetables, veggie burgers are often perceived effective for weight loss and calories control. Furthermore, due to the presence of spices and seasonings, these products represent an alternative to the consumption of whole vegetables and legumes, and so a way to vary the diet. Contrarily, the perceived low availability and variety, expensive prices, unappealing taste and texture are possible factors deterring their purchase. Furthermore, when compared to meat, veggie burgers are often perceived less fulfilling and without enough proteins. Differently from veggie burgers, meat analogues are often negatively perceived. Since the ‘concept’ of this product is not appreciated by most omnivorous, companies should not include in the label the term ‘meat’ as to avoid raising expectations. Taste preferences, unfamiliarity, expensive prices, food neophobia, unnaturalness, and lack of knowledge represent the main barriers limiting their consumption. As a matter of fact, meat replacers are often considered unhealthy alternatives to meat. Even if meat analogues have been created to attract meat-eaters because of the resemblance to meat in terms of taste, appearance and texture, this similarity is not always perceived. Indeed, the consumption of conventional meat among omnivorous students is frequent, therefore dissimilarities between products are immediately detected. Since the market of the modern meat analogues is recent, improvements in the organoleptic properties are expected to take place in the near future in line with advances in food technologies. Additionally, this segment of consumers is strongly tied to culinary traditions, hence it is improbable for current generations to implement their consumption. Among the drivers, curiosity and ease of preparation could act as facilitators toward the consumption of meat analogues. However, it has been proven that curiosity is probably not effective in the long run.

The second sample of respondents – omnivorous eating plant-based alternatives – particularly appreciates veggie burgers, as they are often described as a healthier and environmental-friendly alternative to meat. Taste, texture, availability, variety, ease of preparation and affordability are attributes improving their consumption. However, according to few students, the presence of too many spices could impair with a good digestibility, therefore discouraging the purchase. In line with the previous group, meat analogues are often considered too processed, expensive, and with an unnatural flavour and tex-

ture. Nevertheless, the feeling of disgust and ‘fear’ is not expressed by these consumers. Indeed, meat analogues are perceived by several individuals as a healthier alternative than its conventional counterpart; the ease of preparation, taste, and curiosity are drivers for the consumption of the ‘faux meat’.

Veggie burgers are undoubtedly well accepted by almost all vegetarians and vegans. The fundamental drivers justifying their consumption among this sample concern the animal-welfare, environmental and health-related topics. Other reasons positively influencing their consumption are related to the taste, texture, variety, convenience of preparation, and affordability. Indeed, veggie burgers are the most frequently eaten products among the other plant-based alternatives. However, possible barriers are linked to taste preferences and the consideration that these products are sometimes too processed. Regarding meat analogues, two different opinions emerged. From one side, the modern meat replacers attract those vegetarians and vegans specifically looking for vegetable products resembling the organoleptic qualities of meat; indeed, this category of consumers consider meat analogues beneficial and effective to limit the consumption of conventional meat. On the other side, there is a share of vegetarians who have decided to avoid meat also for its taste. Consequently, they are going to dislike every product resembling it. Beside taste preferences, meat analogues are often perceived convenient to prepare, however the fact that they are processed, expensive and sometimes difficult to find in supermarkets could negatively influence their consumption.

## 5.2 Limitations

The first limitation of the research is related to the selected sample, as for this study only university students living in Veneto were chosen. Another limitation focuses on the qualitative research methodology, due to the possibility of the presence of bias typical of this approach. The aim of the thesis was to study the perception of both veggie burgers and meat analogues. However, not all the respondents belonging to the first group ate the ‘faux meat’, so their opinions were based on personal assumptions.

## **5.3 Recommendations**

### **5.3.1 Recommendations for future research**

To achieve a comprehensive overview of the drivers & barriers for the consumption of plant-based alternatives, the sample size should be improved. Future research is suggested to analyse a wider sample to understand how different educational levels, ages, and locations could influence the perception of these products, and all respondents should have tasted plant-based alternatives at least once to generate answers based on concrete experience. In conclusion, since this topic is recent, more in-depth studies should be carried out focusing only on meat analogues.

### **5.3.2 Recommendations for practitioners**

The information achieved in this research could be useful to companies marketing plant-based alternatives. According to the findings, companies should implement differentiated strategies based on consumers dietary habits. For instance, meat analogues could potentially attract flexitarians and those vegetarian consumers looking for a vegetable alternative with the same organoleptic characteristics of meat. Since several individuals show greater concerns regarding environmental pollution, the packaging of the products should be improved by reducing the amount of plastic in favour of more eco-friendly wrappings.

Almost all respondents are aware of the possible negative impacts of meat consumption regarding environmental, human health, and animal welfare-related issues. Nevertheless, different involvements in relation to these topics characterised the participants. Indeed, meat-reducer and vegetarian students were deeply concerned on animal-welfare issues, environmental sustainability, and health aspects. However, when considering omnivorous avoiding the consumption of plant-based products, the ethical concern related to animal-welfare was not of interest. Consequently, to attract a larger share of consumers, companies should especially promote the positive effects of plant-based products on the environment and human's health by providing specific information.

Although several individuals are aware of the current issues, these are not sufficient to apport modifications to their diet in favour of a reduced consump-

tion of meat. Therefore, specific policies, as dietary guidelines integrating both environmental sustainability and public health goals should be implemented to actively recommend shifts in dietary habits. Another option would be to integrate seminars or dedicated lectures at school to improve the awareness of new generations of students.

As previously discussed, the market of plant-based meat alternatives is recent, therefore advances in food technologies are expected to improve the characteristics of the product and its affordability.



# Appendix A

## Appendix

### A.1 Interview questions

INTRODUCTION: 2-3 minutes

First of all, I introduce myself. I am Ilaria and I am doing research for my thesis in "Italian food and wine", at the University of Padua. The aim of my research is to analyse the eating habits and preferences of university students living in Veneto. I will ask you some questions to understand your eating habits and preferences. The interview will last about an hour.

SOCIO-DEMOGRAPHIC DATA: 2-3 minutes

1. How old are you?
2. Where do you live? Have you always lived in Veneto?
3. What studies did you do? How long have you graduated? Are you still studying? Do you intend to continue with a master's degree (in case of a three-year)?
4. Are you currently a working student? If so, how long do you work during the day? If not, have you ever worked and studied at the same time?
5. Do you live in the city or in the suburbs?
6. Do you live alone or with someone? Who do you live with? How long have you lived alone?

7. Do you play sport? How long have you been practicing it? Do you practice it at a competitive/amateur level? How many hours do you train per week?

EATING HABITS: 10-15 minutes

- Who does the shopping at home? Where do you usually shop (e.g. at the supermarket, market, grocery store, ...)? How often do you shop per week?
- When you shop for food, what do you pay more attention to (e.g. price, quality, health, ...)?
- When you shop, do you read the food label? Nutritional values?
- Who prepares food at home?
- What do you usually eat? How often do you consume meat/fish/vegetables?
- You call yourself omnivorous/vegetarian/vegan, ...?
- *(For vegetarian) How long have you been vegetarian/vegan? Why did you decide to make this choice?*
- Do you think you are a person who pays attention to diet? Do you think you have healthy eating habits?
- Have you ever read articles about nutrition? Do you stay up to date on these topics?
- Are you being followed by a dietician/nutritionist?
- Do you follow a "do-it-yourself diet"? Or do you adapt to what is being prepared?
- Since you practice X sports, do you have to follow a certain diet?
- Are you going to reduce or increase the consumption of any particular food? If so, why?

PERCEPTION AND CONSUMPTION OF PLANT-BASED PRODUCTS:  
15 minutes

**Questions for Group A: omnivorous not consuming PB**

- Have you ever heard of plant-based food? If so, could you tell me what it is? If not, based on the literary translation of the term would you be able to tell me a general idea of what it might be?
- If you know about plant-based, can you list plant-based products?
- Have you ever tasted a plant-based product? If so, which one? Which ones did you like, and which didn't you (why...)?
- Have you ever bought plant-based meat substitutes (e.g. Veggie burgers, vegetable sausages, soy "chicken", ...)?
- On what occasion did you happen to consume them?
- Do you have friends who consume this type of product?
- Have you ever hosted a vegetarian or vegan guest for dinner? If so, have you decided to buy/prepare plant-based foods? What?
- Did you ever happen to be a guest at a vegetarian person's home? On this occasion, did you consume these products?
- What do you think about plant-based products in general?
- If you found them on a restaurant menu, would you order them?
- Are you going to consume them more in the future or not?

**Questions for Group B and C: omnivorous and vegetarians consuming PB**

- How do you define plant-based products?
- Could you list the plant-based products you know? Which ones did you eat?
- How often do you eat this type of product?
- What are the plant-based products that you know but don't eat regularly? Why?

- What kind of plant-based foods do you prefer? (Veggie Burgers, sausages, cold cuts ...)
- Are there any plant-based foods you've consumed that you didn't like? Which one?
- When did you start consuming these products?
- Why did you start consuming them? Is there anyone in your family who consumes them? If so, did it start before or after you?
- *Vegetarians*: When you invite guests to dinner, do you prepare already made plant-based foods or other vegetarian courses made by yourself?
- *Vegetarians*: When you go to the restaurant, do you prefer a plant-based (e.g. veggie or imitation meat burger) or a vegetarian dish?
- On what occasions do you consume them?
- Do you consume them mainly at home?
- Do you order them at restaurant?
- Who usually makes these products at home?
- Do you have friends who consume these products? If so, when you dine together, do you happen to consume them? How often?
- In general, what is your opinion about plant-based food?
- Are you going to consume them more in the future or not?

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DRIVERS AND BARRIERS TO PLANT-BASED FOOD CONSUMPTION (Means-end chain and laddering technique): 15 minutes

- What are the qualities or characteristics that you think about when you're about to buy a plant-based product?
- What drives you to buy and consume plant-based products?
- What do you like about plant-based products?
- What are the characteristics that differentiate a plant-based product from meat?
- Do you think plant-based products can completely replace meat in a diet?

IMPLICIT ASSOCIATIONS WITH PLANT-BASED PRODUCTS (Picture-sorting): 10 minutes

CATEGORY 1: AGE



Figure A.1: Young people (Picture 1)



Figure A.2: Young people (Picture 2)



Figure A.3: Young people (Picture 3)



Figure A.4: Elderly people (Picture 4)

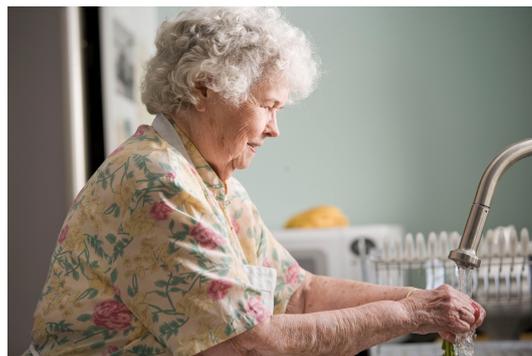


Figure A.5: Elderly people (Picture 5)



Figure A.6: Elderly people (Picture 6)

## CATEGORY 2: STATUS



**Figure A.7:** Upper class (Picture 7)



**Figure A.8:** Upper class (Picture 8)



**Figure A.9:** Upper class (Picture 9)



Figure A.10: Middle class (Picture 10)



Figure A.11: Middle class (Picture 11)



Figure A.12: Middle class (Picture 12)

## CATEGORY 3: SPORT



**Figure A.13:** Fitness (Picture 13)



**Figure A.14:** Competitive sport (Picture 14)



**Figure A.15:** Fitness (Picture 15)



Figure A.16: Competitive sport (Picture 16)

#### CATEGORY 4: MASCULINITY



Figure A.17: Low masculinity (Picture 17)



Figure A.18: Low masculinity (Picture 18)



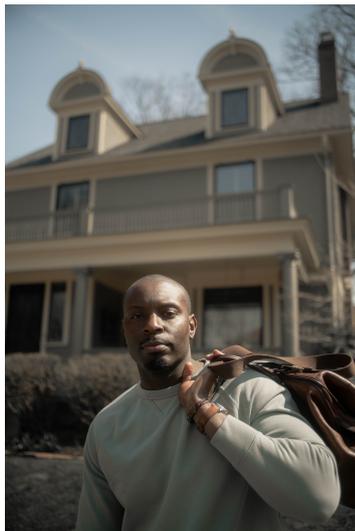
**Figure A.19:** Low masculinity (Picture 19)



**Figure A.20:** High masculinity (Picture 20)



**Figure A.21:** High masculinity (Picture 21)



**Figure A.22:** High masculinity (Picture 22)

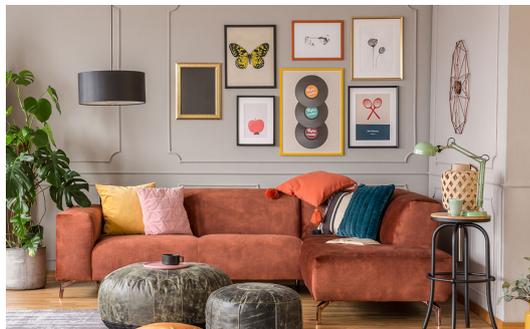
## CATEGORY 5: LIFESTYLE



**Figure A.23:** Traditional (Picture 23)



**Figure A.24:** Modern (Picture 24)



**Figure A.25:** Traditional (Picture 25)



**Figure A.26:** Modern (Picture 26)

### CATEGORY 6: SUSTAINABILITY



**Figure A.27:** Consumerism (Picture 27)



**Figure A.28:** Environmentally-friendly (Picture 28)



**Figure A.29:** Consumerism (Picture 29)



**Figure A.30:** Environmentally-friendly (Picture 30)

The two images representing the two categories: vegetarian diet (Figure A.31 plant-based burger) and omnivorous diet (Figure A.32 beef burger)



**Figure A.31:** Plant-based burger symbolising the category of vegetarian diet



**Figure A.32:** Beef burger symbolising the category of omnivorous diet

All photos were downloaded from the site "Pexels"  
(<https://www.pexels.com/it-it/>)



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