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DEPARTMENT OF FOOD SCIENCE AND HUMAN NUTRITION
CHEMISTRY & FOOD ANALYSIS LABORATORY

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Master Thesis

Consumer understanding and perspectives on plant-based foods

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Κατανόηση και προοπτικές καταναλωτών για τρόφιμα φυτικής προέλευσης

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ABSTRACT

Since the conclusion of World War II, the amount of food produced globally has increased significantly due to combination of economic expansion, population growth, and technical and cultural changes in production methods. The demand for food has greatly grown due to population growth, economic prosperity, and urbanization, which is causing dietary choices to shift toward more resource-intensive meals. In order to meet this task while also preserving the ecosystem's equilibrium, the world food system is under continual strain.

Consumer awareness of the many related environmental, economic, social, and health problems linked to intensive food production and global industrialization is rising. In light of consumers' need for affordable, sustainable, better eating habits, a shift to more sustainable food system is considered required.

Various stakeholders are required to contribute and improve the already-existing healthy alternatives by including alternative components in order for these sustainable food systems to be built. Therefore, goods based on this protein differentiation, or alternative proteins, need to be of a quality and fulfill the demands of the customer that is equivalent to the original products. For the food industry, the future holds a range of expansion potential, financial success, as well as increased competition and the development of new character. Given the relationship between client acceptability and product development, the food replacement process may take several years.

This dissertation sought to study consumers' understandings and perspectives concerning plant-based foods and recognize how dietary shifts and product adoption could be facilitated. Composed of two parts, the theoretical part presents a surveyof the pertinent literature about regular proteins, alternative protein sources, consumers' behavior regarding plant-based food substitutes, consumers' eating habits, and also a reference on the alternative protein industry both globally and nationally. Otherwise, the empirical part

attempts to investigate the research questions concerning consumers' reactions through a targeted questionnaire survey.

The first part goes into more depth about the basic knowledge and the final objective of its application. The protein content of food items and the various kinds of protein that can be found in food are then discussed. The summary of customer categories and nutritional trends, with an emphasis on plant-based diets, follows. Additionally, the present status of the market for different protein goods is discussed on a national and foreign level, emphasizing the need to change the food system.

The research topics and selection plan for the field study that was conducted in the setting of the diplomacy study, along with the methodology research that was used, are presented in the fifth chapter.

The detailed and deductive analysis of the study results was also completed in the sixth part. To make insightful inferences about this new customer tendency and the food and beverage business, the research concentrates on the proper display and handling of the aggregate data.

The research issues are addressed and the findings of the current study are provided in depth in the final part. These findings provide helpful insights into plant protein source goods and the business side when coupled with other literary sources and studies. The research's constraints and practical ramifications are also discussed, along with a number of potential future research paths that could either continue the current study or serve as the basis for a new one.

Finally, the empirical method to the particular object was used with the additional goal of examining elements that support the shift to dietary options that are more viable in terms of human health, environmental consciousness, but also animal wellbeing.

Scientific area: Human nutrition

Keywords: alternative protein sources, plant-based protein sources, alternative products, plant-based substitutes, food and beverage industry, plant-based meat, consumption

Κατανόηση και προοπτικές καταναλωτών για τρόφιμα φυτικής προέλευσης

ΠΜΣ Τρόφιμα, Διατροφή & Υγεία
Τμήμα Επιστήμης Τροφίμων & Διατροφής του Ανθρώπου
Εργαστήριο Χημείας & Ανάλυσης Τροφίμων

ΠΕΡΙΛΗΨΗ

Από την ολοκλήρωση του Β' Παγκοσμίου Πολέμου, ποσότητα τροφίμων που παράγεται παγκοσμίως έχει αυξηθεί σημαντικά λόγω ενός συνδυασμού οικονομικής επέκτασης, αύξησης πληθυσμού και τεχνικών και πολιτισμικών αλλαγών στις μεθόδους παραγωγής. Ζήτηση για τρόφιμα έχει αυξηθεί πολύ λόγω αύξησης πληθυσμού, οικονομικής ευημερίας και αστικοποίησης, γεγονός που προκαλεί στροφή των διατροφικών επιλογών προς γεύματα με μεγαλύτερη ένταση πόρων. Προκειμένου να ανταποκριθεί σε αυτό το καθήκον, διατηρώντας ταυτόχρονα ισορροπία οικοσυστήματος, το παγκόσμιο σύστημα τροφίμων βρίσκεται υπό συνεχή πίεση.

Η ευαισθητοποίηση των καταναλωτών για πολλά σχετικά περιβαλλοντικά, οικονομικά, κοινωνικά και προβλήματα υγείας που συνδέονται με εντατική παραγωγή τροφίμων και παγκόσμια εκβιομηχάνιση αυξάνεται. Λαμβάνοντας υπόψη την ανάγκη των καταναλωτών για προσιτές, βιώσιμες, καλύτερες διατροφικές συνήθειες, θεωρείται απαραίτητη, στροφή σε ένα πιο βιώσιμο σύστημα τροφίμων.

Απαιτούνται διάφοροι ενδιαφερόμενοι να συνεισφέρουν και να βελτιώσουν τις ήδη υπάρχουσες υγιεινές εναλλακτικές λύσεις συμπεριλαμβάνοντας εναλλακτικά συστατικά προκειμένου να δημιουργηθούν βιώσιμα συστήματα τροφίμων. Ως εκ τούτου, προϊόντα που βασίζονται σε διαφοροποίηση πρωτεϊνών ή εναλλακτικές πρωτεΐνες πρέπει να είναι ποιοτικά και να ικανοποιούν απαιτήσεις πελατών που είναι ισοδύναμες με τα αρχικά προϊόντα. Για τη βιομηχανία τροφίμων, το μέλλον επιφυλάσσει σειρά από δυνατότητες επέκτασης, οικονομική επιτυχία, καθώς και αυξημένο ανταγωνισμό και ανάπτυξη νέου χαρακτήρα. Δεδομένης της σχέσης μεταξύ αποδοχής από πελάτη και ανάπτυξης προϊόντων, η διαδικασία αντικατάστασης τροφίμων μπορεί να διαρκέσει αρκετά χρόνια.

Αυτή η διατριβή προσπάθησε να μελετήσει αντιλήψεις και απόψεις των καταναλωτών σχετικά με φυτικά τρόφιμα και να αναγνωρίσει πώς θα μπορούσαν να διευκολυνθούν

διατροφικές αλλαγές και υιοθέτηση προϊόντων. Αποτελούμενο από δύο μέρη, στο θεωρητικό μέρος παρουσιάζεται μια έρευνα σχετικής βιβλιογραφίας σχετικά με κανονικές πρωτεΐνες, εναλλακτικές πηγές πρωτεΐνης, συμπεριφορά καταναλωτών σχετικά με φυτικά υποκατάστατα τροφίμων, διατροφικές συνήθειες καταναλωτών και επίσης αναφέρεται στη βιομηχανία εναλλακτικών πρωτεϊνών παγκοσμίως και σε εθνικό επίπεδο. Διαφορετικά, στο εμπειρικό μέρος επιχειρείται να διερευνηθούν ερευνητικά ερωτήματα που αφορούν αντιδράσεις καταναλωτών μέσω μιας στοχευμένης έρευνας ερωτηματολογίου.

Στο πρώτο μέρος εμβαθύνονται βασικές γνώσεις με τελικό στόχο εφαρμογής τους. Στη συνέχεια συζητείται περιεκτικότητα σε πρωτεΐνες ειδών διατροφής και διάφορα είδη πρωτεΐνης που μπορούν να βρεθούν στα τρόφιμα. Ακολουθεί περίληψη κατηγοριών πελατών και διατροφικών τάσεων, με έμφαση στις φυτικές δίαιτες. Επιπλέον, η παρούσα κατάσταση αγοράς για διάφορα πρωτεϊνικά προϊόντα συζητείται σε εθνικό και εξωτερικό επίπεδο, τονίζοντας ανάγκη αλλαγής συστήματος τροφίμων.

Ερευνητικά θέματα και σχέδιο επιλογής για επιτόπια μελέτη που πραγματοποιήθηκε στο πλαίσιο της διπλωματικής μελέτης, μαζί με μεθοδολογική έρευνα που χρησιμοποιήθηκε, παρουσιάζονται στο πέμπτο κεφάλαιο.

Λεπτομερής και απαγωγική ανάλυση αποτελεσμάτων μελέτης ολοκληρώθηκε επίσης στο έκτο μέρος. Για να βγουν οξυδερκή συμπεράσματα σχετικά με την νέα τάση πελατών και την επιχείρηση τροφίμων και ποτών, η έρευνα επικεντρώνεται στη σωστή εμφάνιση και διαχείριση συγκεντρωτικών δεδομένων.

Ερευνητικά ζητήματα εξετάζονται και ευρήματα της παρούσας μελέτης παρέχονται σε βάθος στο τελευταίο μέρος. Ευρήματα παρέχουν χρήσιμες πληροφορίες για τα αγαθά που προέρχονται από φυτικές πρωτεΐνες και την επιχειρηματική πλευρά, όταν συνδυάζονται με λογοτεχνικές πηγές και μελέτες. Περιορισμοί και πρακτικές προεκτάσεις έρευνας συζητούνται επίσης, μαζί με σειρά από πιθανές μελλοντικές ερευνητικές διαδρομές που θα μπορούσαν είτε να συνεχίσουν την τρέχουσα μελέτη είτε να χρησιμεύσουν ως βάση για νέα.

Τέλος, χρησιμοποιήθηκε εμπειρική μέθοδος στο συγκεκριμένο αντικείμενο με πρόσθετο στόχο εξέτασης στοιχείων που υποστηρίζουν στροφή σε διατροφικές επιλογές που είναι πιο βιώσιμες όσον αφορά ανθρώπινη υγεία, περιβαλλοντική συνείδηση, αλλά

και ευημερία των ζώων.

Επιστημονική περιοχή: Διατροφή του ανθρώπου

Λέξεις κλειδιά: εναλλακτικές πηγές πρωτεΐνης, φυτικές πηγές πρωτεϊνών, εναλλακτικά προϊόντα, υποκατάστατα φυτικής προέλευσης, βιομηχανία τροφίμων και ποτών, φυτικό κρέας, κατανάλωση

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Pappos Nikolaos

Athens, 2023

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1. INTRODUCTION

1.1 Overview

A remarkable evaluation estimates the world population is set to be raised around 10 billion by the year 2050. At the same time, food and agricultural systems head to be going through unprecedented challenges due to overpopulation, urbanization, and growing incomes as well. The demand for both meat and milk consumption is appreciated to grow by 73% and 58% respectively between 2010 and 2050 (Steinfeld H. et al., 2013). This requirement has to be implemented within a sustainable system in order to feed the whole world, especially western societies, and to become affordable, ethical, and environmental-friendly. Consumers have already been searching for new richer diets and increasingly diversified such as vegetarian, vegan and flexitarian diets, given the fact that meanwhile many public debates are held for meat production, consumption and animal prosperity, regarding the negative externalities within livestock production (Bonnet C. et al., 2020). Growing demand for animal protein, which requires more intensive utilization of natural resources as a result of adverse consequences for the planet, environmental issues, such as climate change, biodiversity loss, as well as planet's overheating. Therefore, it is set necessary for the alimentation issue to be handled by converting the global food system towards ecosystem sustainability (Michel et al., 2021).

In recent years, products with a high protein content or various protein sources in the food and beverage industry, have attracted progressively consumer interest. Particularly, a growing target market has been developed rapidly composed of foods and beverages with added protein, protein supplements, products with high natural protein content, and especially alternative protein sources, which is orientated towards a consumer audience mainly interested in health and sustainability issues (Wood P. & Tavan M., 2022).

The choice of the amount and the alternative protein source is determined by various factors, such as the environment and sustainability, which motivate animal protein consumption into plant-based protein product consumption. In parallel with population growth, future protein demand is undoubtedly affected as well (Boer et al., 2013).

In developing high- and middle-income countries, alternative protein products are sold in the food and beverage industry, which constitute a small market share so far. However, as time passes, this market tends to grow constantly, and alternative protein sources are becoming targeted to daily dietary choices by most consumers (WEF, 2019). In order to be achieved, big-scale companies will contribute, having the necessary resources and the ability to make appropriate use of production technologies, marketing, and distribution channels. However, if this becomes impossible, higher prices are about to be set on products with alternative protein sources focusing on a specific target market.

1.2 Objectives

This dissertation sought to study consumers' understandings and perspectives concerning plant-based foods and recognize how dietary shifts and product adoption could be facilitated. The survey also studies the requirement for more sustainable food choices driven by human health and environmental awareness, which motivates consumers. Both food neophobia and the reasons that consumers avoid or prefer plant-based food substitutes are deemed necessary to analyze as well.

The approach of the specific object will be carried out to be utilized by any stakeholder who wants to know about the understanding and perspectives of consumers concerning plant-based foods. Addressed either to food companies that want to expand their database on this kind of food for future purposes or to any nutritional research on new consumer trends.

1.3 Research structure

A bibliographic review is presented in the first four chapters of this thesis, which was carried out in order to inform about the importance of protein itself, consumers' behavior, and the food industry concerning alternative proteins both in the whole world and in Greece as well. In addition, the fifth chapter analyzes the research methodology, while the sixth and seventh chapters present the statistical analysis and the research results, respectively. Finally, in the eighth chapter, the main conclusions of the specific study are mentioned. The

bibliography on which the writing of this thesis was contacted is indicated in the ninth chapter.

2. PROTEINS

2.1 Overview

Food proteins reveal a variety of functions depending on their chemical composition, physical structure and how they interact with other food components and the process environment. The set of properties of food ingredients, other than nutrients, that affect their use in food, is defined as functionality. These physicochemical properties of proteins determine their behavior in food systems during production, storage, preparation and consumption and therefore affect the quality and acceptance of the food by the consumer. For this reason, protein incorporation into foods is often observed to improve processed foods' taste, texture and other organoleptic characteristics (Haque M.A. et al., 2016). In addition, the nutritional value of protein varies depending on amino acid profile, bioavailability, digestibility, purity, but also the processing process (Han S. et al. 2015).

Amino acids determine both the structure and function of proteins and by extension their biological value (Berg, J. et al., 2002). As their name suggests, amino acids contain an amino group (-NH2) and a carboxyl group (-COOH). When the amino and carboxyl groups are attached to the same carbon, they form an α-amino acid. Another group is attached to this same carbon, which is called a side group, and it is because of this that each amino acid is unique. Compared with all α-amino acids that occur in nature, only 20 are used for the synthesis of proteins in the human body. The union of amino acids is carried out by the so-called peptide bond, while their sequence determines the protein's structure and function (Kato K. et al., 2022).

Amino acids are structural units of proteins. Of the twenty amino acids, which are found in proteins, eleven are synthesized in the cells of the human body, while the remaining nine are called essential amino acids and because they are not synthesized, it is necessary to get them through the diet. However, some of the essential amino acids are found in foods with

less than the optimal recommended content and are thus called limiting amino acids (Friedman M., 1996).

The recommended amounts of proteins that must be included in a balanced human diet have been determined, throughout the world. The European Food Safety Authority (EFSA) set the amount of 0.83 grams (g) of protein per kilogram of body weight (EFSA, 2012), which is in agreement with the World Organization (World Health Organization, WHO), which defines the intake of a safe level of protein at 0.83 g per kilogram (Kg) per day as well, which is expected to cover the protein needs of 97.5% of the world's healthy adult population (WHO/ FAO, 2007). Similar values are found in the United States and Canada, where 46 g and 54 g per day are recommended for women and men, respectively, which was determined based on a statistical model, including approximately 98% of the population, in order to account for existing differences in age, pregnancy, and lactation (Mavra A. et al., 2021). Finally, in the Nordic countries they report the recommended amount of protein as 0.80-0.83 g/Kg body weight for both men and women with moderate levels of physical activity (Fogelholm, M., 2013).

According to a study conducted by Future Market Insights (FMI), the global plant-based protein market enjoyed a year-on-year (YOY) growth of 6.7% in 2021 to total sales of USD 11.3 and is projected to surpass USD 22.5 in 2032 at a Compound Annual Growth Rate (CAGR) of 7.2%, according to market analysis (FMI, 2022). Additionally, plant sources in the global protein supply chain of protein are dominated with a percentage of 57%, followed by proteins originating from meat at 18%, from dairy products at 10%, as well as from fish and shellfish at 6%. The remaining 9% of the protein comes from other animal products (FAO, 2010).

High meat prices are pushing the food industry to produce meat-free proteins. A remarkable reason for the increased acceptance of plant proteins, such as textured soy protein (TSP), is their low cost (Singh et al., 2008). Moreover, animal proteins are scarce in many developed countries, and protein-energy malnutrition is among the most serious problems facing developing countries today (Boye et al., 2010). Due to animal diseases such as mad cow disease, global shortage of animal protein, strong demand for healthy and safe food, and economic reasons, pressure is put on the direct consumption of plant-based protein in food. Nevertheless, although there are many plant sources of protein in nature, which can be added to the human diet and contribute to solving the nutritional problem (Chaudhary, A.

et al., 2018), protein from animal sources is the dominant source of protein meeting human nutritional needs so far (Henchion, M. et al., 2017).

2.2 Animal and Plant proteins

2.2.1 Health effects

The most critical role nutrition plays in practically all facets of human life and activity on Earth is survival. As mentioned in this treatise, nutrition affects people's moods, populations' economic and social well-being, natural ecosystems' peace and order, the preservation of the environment, and the health of the planet as a whole. Above all, however, nutrition affects individuals' health and healthy or unhealthy life. Nutrition is inextricably linked to people's health, so is inevitably the consumption of the right proteins. The incidence of obesity, cardiovascular illnesses, and various forms of cancer is rising globally in the early decades of the twenty-first century, particularly in the Western World. Among other things, the excessive consumption of animal meat proteins is responsible for them. Production and increased demand for plant proteins can provide a solution, replacing animal protein and lowering the rates of the previously mentioned diseases (Carroll E. A. et al., 2019).

In the Western World (Europe, America, and Australia), more favorable conditions allow the production and consumption of meat to the extent of the excess. The financial conditions of general prosperity, and more liberal politics and culture, make meat readily accessible to both the producer and the consumer. Therefore, excessive meat consumption occurs more in the Western World; inevitably, that is where most of the health problems from this excessive consumption occur (Adams V., 2022).

As an illustration, consider the United States, the region's acknowledged economic superpower. The US ranks seventh in the world for meat consumption per person. According to the Dietary Guidelines for Americans, a study conducted between 2015 and 2020, US meat intake is 20–60% over what is considered healthy. Heart disease, stroke, type 2 diabetes, and obesity are all connected to overeating meat, especially red, chemically treated, and processed meat. There is a relationship between red and processed meat and more significant overall, cardiovascular, and cancer mortality risks (Neff A. R. et al., 2018).

The World Health Organization (WHO) has classified processed beef as "carcinogenic to people" and red meat in general as "possibly carcinogenic to humans." However, this WHO declaration has sparked conflicting views among specialists. According to certain research, red meat is "possibly carcinogenic" and processed meat is "carcinogenic." According to other studies, there is insufficient evidence to indicate a connection between eating red meat and colon cancer and cardiovascular disease. In these investigations, the majority of participants consumed varying amounts of red meat without any changes in their cardiovascular test results. Obviously, all of these investigations were thorough and sampled, yet they were unable to change the WHO's viewpoint (Carroll E. A. et al., 2019; Johnston C. B. et. al., 2019).

Studies and analyses generally show that in high-income Western nations, participants with a high intake of red and processed meat have moderately higher overall mortality rates than participants with a low intake of meat, while no or moderate rates have been observed for poultry (Godfray J. C. H. et al., 2018). Given that the data required to statistically quantify the influence of these confounders may not be available, a portion of this may be attributable to the link between excessive meat consumption and other significant risk factors, such as smoking, alcohol use, and obesity.

Eating meat clearly has benefits as well as drawbacks. Meat provides energy as well as a variety of necessary elements such as protein and micronutrients such as iron, zinc, and vitamin B12. However, if a broad range of other foods is accessible and eaten, it is feasible to achieve appropriate intakes of these nutrients without eating meat. That is, not all nutrients may be obtained by substituting meat. In India, for example, 35% of the population is vegetarian, and studies have indicated that vegetarians have a somewhat better health profile than non-vegetarians (Godfray J. C. H. et al., 2018).

Even though excessive meat eating has been shown to create health issues, there are reasons why individuals do not firmly refuse to cut their consumption or replace it with a replacement (Neff A. R. et al., 2018; Rochow, 2009). The following are the reasons:

- The notion that consuming meat is both an inevitable pleasure and a necessary component of a healthy diet.
- Some people's cultures depend heavily on meat.
- The apprehension of attempting meatless dishes because of their taste.

- The idea that vegetarianism was legitimate and the notion that other bad habits, like smoking, were to blame.
- Concentration and emphasis on other healthy behaviors like exercising and increasing fruit and vegetable intake without automatically lowering meat consumption.
- Skepticism about scientific guidance.

All people, regardless of culture, need to be made aware of the advantages and disadvantages of eating meat. More broadly, research has shown that rectal and colon cancer provide the most support for the claim that eating a lot of meat is bad for your health. Red meat is classed as a potential human carcinogen, again based mostly on the components of relation with rectal/colon cancer, and processed meat is designated as a human carcinogen owing to its association with rectal/colon cancer by the WHO's International Agency for Research on Cancer (IARC). IARC estimates that diets high in processed meat are responsible for 34,000 cancer deaths per year globally, and if the documented connections with red meat are causative, diets rich in red meat may be to blame for 50,000 cancer deaths per year globally. According to the IARC research, the average daily consumption of processed beef in Western Europe [26.4g] would result in a 9% increase in the risk of developing rectal cancer. There is some evidence that eating a lot of processed meat may raise your chance of developing stomach cancer, but there isn't any conclusive proof that it does the same for other cancers (Godfray J. C. H. et al., 2018).

Table 2.1: Quintile of Red Meat Consumption, Chicken and Fish Consumption, and the Ratio Between Them: Age-Adjusted Relative Risk of Colon Cancer

Variable	Quintile					χ for Trend (P Value)
	1	2	3	4	5	
Red meat† (g/day)	<59	59–83	84–105	106–133	≥134	
Cases	25	27	28	26	44	
Person-years	97,680	100,565	100,299	100,402	111,879	
Relative risk (95% CI)	1.0	1.16 (0.67–1.99)	1.25 (0.73–2.13)	1.13 (0.65–1.97)	1.77 (1.09–2.88)	+2.20 (0.03)
Chicken and fish‡ (g/day)	<22	22–28	29–40	41–64	≥65	
Cases	38	29	39	19	25	
Person-years	99,641	102,400	103,950	102,489	102,345	
Relative risk (95% CI)	1.0	0.75 (0.46–1.22)	0.99 (0.63–1.54)	0.47 (0.27–0.81)	0.56 (0.34–0.92)	−2.63 (0.009)
Ratio of red meat to chicken and fish	<1.2	1.2–2.0	2.1–3.2	3.3–5.1	≥5.2	
Cases	22	26	27	29	46	
Person-years	101,091	100,999	103,016	101,965	103,754	
Relative risk (95% CI)	1.0	1.33 (0.75–2.37)	1.43 (0.80–2.54)	1.60 (0.90–2.83)	2.49 (1.50–4.13)	+3.47 (0.0005)

Because of cross-correlations, it might be challenging to understand how certain diets are associated with a higher risk of developing colon cancer. For instance, although fish and chicken are often suggested as alternatives to red meat, their consumption was adversely associated (r = -0.21). Total intake of red meat (consumption of beef, hog, and lamb from all sources), total intake of chicken, and total intake of fish were computed to illustrate this replacement pattern (**Table 2.1**), (Willett C. W. et al., 1990).

Total consumption of red meat was positively correlated with the risk of colon cancer, as was predicted from the results for specific items, whereas total intake of chicken and fish was associated with a lower incidence of the condition. According to the ratio of red meat in the women's diets compared to chicken and fish, the top quintile was shown to have a roughly 2-and-a-half-times higher risk of colon cancer than the lowest quintile (relative risk, 2.49; 95% CI, 1.50 to 4.13; P for trend = 0.0005). When the total intakes of red meat, chicken, and fish were reported as a difference rather than a ratio to represent absolute consumption, a similar connection was seen (relative risk for highest vs. lowest quintile, 2.44; 95 percent confidence interval, 1.44 to 4.14), (Willett C. W. et al., 1990).

2.2.2 Effect of plant-based food consumption on the environment

While the globe is in the early decades of the twenty-first century, it is experiencing extremely significant environmental issues as a result of human activities in many different sectors. Climate change brought on by ozone depletion and environmental degradation is now accepted as truth. Mitigation of Climate Change, a study from the United Nations' Intergovernmental Panel on Climate Change, switching to a plant-based diet has a high potential for lowering carbon footprints, combating climate change, and enhancing human health. According to the authors of Climate Change 2022, studies show that switching to plant-based diets rich in pulses, nuts, fruits, and vegetables could result in a significant decrease in greenhouse gas emissions when compared to the dietary habits prevalent in the majority of industrialized nations today. Reduced risk of cardiovascular disease, type 2 diabetes, and mortality from diet-related noncommunicable illnesses are listed as additional co-benefits in the paper (Willet W. et al., 2019).

By 2050, a worldwide transition to a plant-based diet may cut greenhouse gas emissions from food production by 10% and mortality by 70%. Animal products, including

meat and dairy, "often demand more resources and create more emissions than plant-based alternatives," according to a research from the United Nations Environment Programme (Hertwich E. et al., 2010). Reducing cattle herds would also cut methane emissions, which are the second major cause of global warming after carbon dioxide, according to the World Health Organization (Bull World Health Organ, 2014).

According to a research released last year, limiting meat production is essential for lowering greenhouse gas emissions. As stated in the report, meat and dairy products account for 57% of all greenhouse gas emissions related to food production. According to the report, beef is the main source of world greenhouse gas emissions. Only 29% of the world's greenhouse gas emissions connected to food originate from plant-based diets (Xu X. et al., 2021).

Following another study by the Institute for Agriculture and Trade Policy and the Changing Markets Foundation, the methane emissions of five of the biggest meat companies and ten of the biggest dairy companies—including JBS, Tyson, and the Dairy Farmers of America—are equivalent to more than 80% of the entire methane footprint of the European Union (IATP, 2022). Based on a recent Gallup Poll, environmental concerns are the second most important factor influencing decreased meat consumption after health: seven in ten people believe environmental issues are the reason they don't eat meat (McCarthy J. & Dekoster S., 2020).

The United States could be able to reduce greenhouse gas emissions by switching from beef to beans (Harwatt H. et al., 2017). Researchers examined projected net emissions from the cultivation of legumes, deducted them from rates of ordinary beef production, and used the United States' 2020 reduction targets as a benchmark. According to the findings, substituting legumes might cover 46-74% of the necessary cuts. A standard fast food hamburger weighing 75 grams every day for a year produces the same amount of greenhouse gas emissions as driving a vehicle 7,196 miles, or almost 2.5 times around the circumference of the United States. In comparison, 93 miles of driving are equal to 150 grams of beans, or roughly a third of a can, consumed every day for a year (Stylianou N. et al., 2019).

2.2.3 Effect of meat consumption on the environment

The contemporary period of industrialization, scientific advancement, and rising human demands has shown a clear relationship between affluence and meat consumption. The growth in earnings and the expansion of the global population have both contributed to the expansion of animal husbandry. The worldwide annual output of meat was 218 million tons in the years 1997–1998; by 2030, it is expected to reach 376 million tons (Godfray J. C. H. et al., 2018).

Moreover, the Food and Agriculture Organization of the United Nations reports that the per capita consumption of meat has almost doubled since the early 1960s, contributing to the recent large rise in meat consumption worldwide (FAO). In the 1960s, each individual consumed an average of 23.1 kilograms (50.8 pounds) of meat yearly; by 2019, that number had increased to 43.2 kilos. According to studies, nations with more affluence often eat more meat. According to projections, per capita meat consumption in industrialized countries is expected to increase to 69.5 kilograms in 2022, compared to only 27.6 kilograms in underdeveloped countries (Brändlin A. S., 2022).

As the production of all livestock products necessitates the dedication of agricultural land for pastures, the production of raw materials, and the manufacture of animal feed, this rise might be terrible for the environment. 80% of the land that is accessible worldwide is included in the proportion of agricultural land. And all of this, given that not everyone's nutritional requirements are met, is done to cover less than 20% of the calories required by mankind. Additionally, the ongoing requirement to develop land plots for cattle contributes to deforestation and forest area degradation, particularly in Latin America (Godfray J. C. H. et al., 2018).

Air pollution is also a result of meat consumption. 15% of the world's greenhouse gas emissions are related to livestock farming. Methane (from animal digestion and excretions), nitrogen, phosphorus, and other gases make up the majority of these gases (Godfray J. C. H. et al., 2018). Because it heats the atmosphere 26 times more than carbon dioxide, methane is bad for the ozone (Godfray J. C. H. et al., 2018). The manufacturing of meat produces gases like nitrogen, phosphorus, and other pollutants that greatly impact biodiversity. The western world, notably the USA, consumes much too much meat these days, which clearly has a negative impact on the environment to a significant degree. More greenhouse gas emission is seen in these regions with high meat production and consumption.

It is noteworthy to mention that one of the main causes of global warming is livestock production (Allen & Hof, 2019). As a result, it's important to measure and take into account the environmental effects of meat consumption. One of the most popular methods for doing this is Life Cycle Evaluation (LCA). Environmental effects of climate change, such as acidification, land and water consumption, and eutrophication, are evaluated via life cycle assessments (LCA). It is necessary to first identify which eating practices are more ecologically beneficial. To achieve this, a recent LCA research on several meal kinds was conducted, and the scientists discovered that the meals with the largest environmental effect comprised red meat (Heard B. R. et al., 2019).

Four different food scenarios' carbon footprints were calculated using LCA in another study done in Denmark (standard, carnivore, vegetarian and vegan). From agricultural production to consumption, all activities were considered. Carnivore diets had the largest environmental effect, as shown by the findings that they produce more CO2 (1.83 t CO2eq/person/year). Other diets, including vegetarianism or veganism, however, exhibited lower emissions (0.89 and 1.37 t CO2eq /person/year, respectively) (Bruno et al., 2019).

These findings align with those of a Canadian study that evaluated the carbon footprint resulting from various food habits (Veeramani A. et al., 2017). Farm productivity as well as domestic tasks like cooking and storing were taken into account. The biggest carbon footprint was shown by dietary practices that included beef meat, such as omnivorous diets and diets devoid of hog meat (3160 kg CO2eq and 2282 kg CO2eq, respectively). Different diets with other meats but no beef meat had a carbon footprint that was 60% lower than the no-pork diet. Vegetarian and vegan diets also have the least amount of carbon emissions (55 and 1015 kg CO2eq, respectively) (Veeramani A. et al., 2017). The majority of findings generally support that meat products, followed by dairy products, are the commodities with the highest environmental effect. This is because different agronomic and zootechnical activities are involved (Notarnicola B. et al., 2017).

After establishing which diets are the greenest, it's critical to evaluate the environmental effects of meat production in particular. Regarding a study, several writers assessed the environmental effects of five distinct manufacturing systems using a life cycle assessment (LCA). When evaluating lamb production on a mass basis, the findings of the LCA revealed that the carbon footprint varied from 3.9 to 30.6 kilograms CO2e/kg meat, and between 10.4 to 18.1 kg CO2e/kg meat when considering lamb production on an economic

basis. Additionally, it's crucial to note that enteric methane emissions made for much to 72% of all emissions (Dougherty C. et al., 2019).

2.3 Modern proteins

2.3.1 Plant-based proteins

Plant-based proteins are first introduced into consumers' diets in an attempt to replace animal proteins in their everyday lives. Legumes (lentils, chickpeas, peas, peanuts, soybeans, fava beans), grains (quinoa, rice, oats), fruits (almonds, pumpkin, cashews, hazelnuts), vegetables (mushrooms, spinach, potatoes, maize), and spirulina are the primary sources of plant-based proteins (Tarté R., 2009).

Figure 2.1: Plant-Based Sources of Protein (American Heart Association, 2020).

(https://www.heart.org/)

The findings of procedures employed by the Food and Agriculture Organization of the United Nations (FAO) to evaluate the quality of plant-based proteins in the past have been made public. Particularly, since 1989, the number, as a score of amino acids, of protein digestibility (PDCAAS) has been recorded, indicating values near one for the majority of milk, egg, and meat animal proteins. In contrast, plant-based proteins barely reach the unit, with potato, pea, and quinoa serving as prominent examples. However, these assessments do not indicate that plant-based proteins are inferior. In reality, the intake of more plant-based proteins results in a larger proportion of essential amino acids while without burdening the body with additional calories, as is typical with animal products. In the food business, there is an abundance of plant-based protein isolates and concentrates (soybean, pea, rapeseed, potato, fava bean, etc.) that are high in essential amino acids (Hertzler et al., 2020).

To maintain optimum muscle growth, strength, and function, a diet rich in high-quality protein should include 0.8 g per kilogram of body weight (BW) each day (Wu et al., 2021). Animal products are the best sources of protein for humans (Kärenlampi & White, 2009).

Plant-based proteins are often present and generally responsive to the body's signals. However, it should be noted that plant-based proteins vary in quality from animal proteins, therefore we must be cautious with recommendations that lean toward this substitute source (Hertzler et al., 2020). The protein composition of various plant sources is listed in **Figure 2.2.**

Oat protein is said to be almost as high-quality as soy protein. Oat protein is significant since soy protein is comparable to that of meat, milk, and eggs, according to the World Health Organization (Mushtaq et al., 2014). It was discovered that throughout the formation of pea seeds, significant quantities of proteins are accumulated. The protein content of the seed ranges from 18% to 30% depending on the variety, the habitat, and other factors. Methionine is the limiting amino acid in pea proteins, which unlike proteins from animal sources include necessary amino acids in required quantities (Tulbek et al., 2016).

Recently, it has also been shown that the application of enzymatic treatments enhances the functional activities of pea proteins. Due to the presence of acid proteases, the produced emulsion following transglutaminase treatment had better strength and had a greater potential to emulsify. These processes helped transform the isolated pea proteins into useful ones that are similar to egg white and soy proteins (Tulbek et al., 2016).

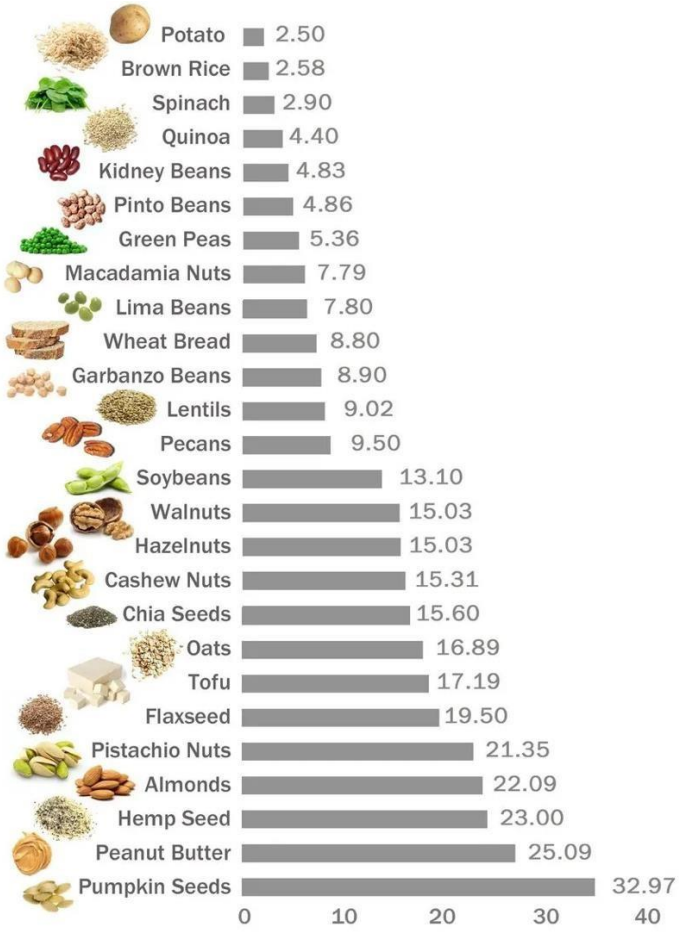

Figure 2.2: Protein content of different plant sources per 100g in weight (Vinchay Fit Cards, 2018)

(https://teamvinchay.org/)

Additionally, studies have been done on the value of plant-based proteins for consumer health. The association between proteins and conditions including cancer, diabetes, obesity, heart disease, and maybe even type 2 diabetes, as well as their status as a functional food. The aforementioned demonstrates the necessity for more research (Hertzler et al., 2020). The hemp seed is an additional source of plant-based protein (Cannabis sativa L.). The Cannabaceae family of plants includes the herbaceous plant known as hemp. It is produced for commercial, pharmacological, or even recreational uses, with the first two applications seeing an increase in demand (Farinon et al., 2020). Depending on the type and environmental circumstances, the inner section of hemp seeds contains 20–25% proteins that are simple to digest and abundant in important amino acids. Globin and albumin make up a

typical 60–80% and 20–40% of all proteins, respectively. Globulins are 93% 11S hestedin and 7% 7S globulin (vicillin), respectively (Potin et al., 2019).

There are three distinct forms of estedine, each with a unique amino acid composition and molecular weight, but they are all high in arginine. It naturally contains all the necessary amino acids that the human body needs, with glutamic acid being the most prevalent (3.74–4.58% of the entire fruit), followed by arginine (2.28–3.10% of the total fruit), and lysine being the least prevalent (less than 1% of the total fruit). The value of non-essential amino acids cannot be overstated. One such amino acid is arginine, which among other things helps to define hemp seed as a supplement for optimum immune system health and muscle recovery (Farinon et al., 2020).

It is well-recognized that quinoa has a beneficial impact on a consumer's health. Between 13.8% and 16.5% of the dry matter of quinoa seeds is protein. It has a low concentration of prolamins and is mostly composed of globulins (37%) and albumins (35%). It is claimed to have a comparable protein value as milk caseins since it includes necessary amino acids. According to a research, 22 university students between the ages of 18 and 45 who consumed quinoa candy for 30 days had substantial drops in their levels of triglycerides, high cholesterol, LDL, blood sugar, and blood pressure (Navruz-Varli & Sanlier, 2016).

Protein-rich plant foods include rice and wheat. Proteins emerge in wheat bran at an average rate of 8.3-19.3% and in rice bran at an average rate of 12-20%. The major ones are albumin (23.5 percent for flour and 37% for rice), globulin (15.5% for flour and 36% for rice), prolamin (18.5%), and glutenin (25.5 percent). Because they include a high amount of important amino acids, such as histidine, arginine, valine, methionine, and cheese, rice bran proteins are said to have a high nutritional load (Sozer et al., 2017).

In light of the discovery of new, very intriguing possibilities surrounding plants, it is suggested that their constituent parts be kept apart from their source. Complex procedures are used to purify isolated proteins once they are extracted from plant sources in order to use them in everything from manufacture to consumption. The industry employs cutting-edge plant-based isolation techniques to address the shortage of protein (Bilek, 2018).

The present focus on a protein isolation technique has made it clear that several elements affect the procedure. The plant, the plant's component, the process itself, and the variable solvent High-grade protein may be obtained using both traditional and modern methods. Industry uses conventional or non-conventional dry or wet protein extraction

techniques to produce protein products that can be divided into three categories: protein flour (with up to 65% protein presence), protein concentrates (with up to 65-90% protein presence), and protein isolates (with over 90% protein presence) (Bilek, 2018; Kumar et al., 2021.

2.3.2 Fungal-based protein

Microorganisms are a newly discovered source of protein that may satisfy the dietary and aesthetic requirements of customers (Fasolin et al., 2019). Their capacity to grow on basic organic substrates encourages the industrial-scale cultivation of edible microbial mass in areas where agricultural output is not in competition with it, while also assisting in the management of agricultural inputs and lowering food loss (Linder, 2019).

Microbial protein is a term used to describe proteins obtained from single or multiple-cell microorganisms and utilized as a source of food or feed. Up to 75% of dry microbial biomass is abundant in protein and includes all nine necessary amino acids. Bacteria, fungi (yeasts and filamentous fungus), and microalgae are some of these microorganisms (cyanobacteria and unicellular eukaryotes). 2019 (Fasolin et al.) Industry knowledge of the regulated and intensive systems known as bioreactors for the synthesis of microbial protein (MP) is growing (Lippolis et al., 2019).

The protein quantity and quality of microorganisms vary according to the kind of microbe, substrate, cell development stage, nutrition sources, and environmental growth circumstances. As a consequence, microbes are now considered a source of high-quality proteins. The separated protein may be classified as a food or additive, such as a preservative or coloring agent, with the intention of enhancing and enhancing food preparations (Fasolin et al., 2019).

Mycoproteins, or microbial proteins generated from fungus, are partial or complete alternatives for protein-rich meals such as meat (Hashempour-Baltork et al., 2020). Mycoprotein is generated through solid, semi-solid, or submerged fermentation, with submersion exhibiting the highest efficiency (Landeta-Salgado et al., 2021). In contrast to HOB, fungus need an organic carbon source (such as sugars), fresh water, and arable soil to grow. Their manufacture is more environmentally friendly than that of beef. Mycoprotein is likewise a source of high-quality proteins, including all the essential amino acids and has a

biological value equivalent to that of milk proteins. Table 1.7 compares the differences between mycoprotein and meat (Lippolis et al., 2019).

The market for dry mycoprotein, which typically includes 45g of protein per 100g, is anticipated to grow by 20% in the next year (Lippolis et al., 2019). Mycoproteins have a nearly 1.0 protein digestibility adjusted amino acid (AA) score. The varieties of microorganisms and substrates, as well as their collection, drying, and processing techniques, are factors determining the nutritional value of mycoproteins and their composition (Hashempour-Baltork et al., 2020).

Quorn is a well-known example of mycoproteins from filamentous fungus. Mycoprotein, a paste with around 50% dry weight content, is produced when Fusarium venenatum is grown under sterile circumstances (HashempourBaltork et al., 2020; Lippolis et al., 2019). Products from Quorn include chicken cubes, meatless mince, and more (Mistry et al., 2020)

Table 2.2: Comparison of the amount of essential amino acids per 100 grams of mycoprotein versus other sources of protein (Marlow Foods Ltd, 2008).

Essential Amino Acids	Mycoprotein	Cow's milk	Egg	Beef	Soy isolate	Soy concentrate	Peanuts	Wheat
Histidine	0.39	0.09	0.30	0.66	0.6	0.4	0.65	0.32
Isoleucine	0.57	0.20	0.68	0.87	1.1	0.8	0.91	0.53
Leucine	0.95	0.32	1.10	1.53	1.8	1.3	1.67	0.93
Lysine	0.91	0.26	0.90	1.60	1.4	1	0.92	0.30
Methionine	0.23	0.08	0.39	0.50	0.3	0.2	0.32	0.22
Phenylalanine	0.54	0.16	0.66	0.76	1.1	0.9	1.30	0.68
Tryptophan	0.18	0.05	0.16	0.22	0.3	0.2	0.25	0.18
Threonine	0.61	0.15	0.60	0.84	0.8	0.7	0.88	0.37
Valine	0.60	0.22	0.76	0.94	1.1	0.8	1.08	0.59

2.3.3 Cell culture-based protein

The objective of producing cell culture meat is to create processes that will enable the industrial manufacture of a successful and financially feasible product that will have the genuine structure, texture, and taste of a traditional piece of meat. This necessitates a complicated system with many cell types that develop in an orderly fashion and a structure that needs a network of blood arteries to provide all cells with the nutrients they need.

Producing muscle protein just from muscle cells and combining it with fat cells to create ground beef is a more straightforward and doable aim (Post et al., 2020).

The cell culture meat production technique consists of a number of phases (**Figure 2.3**), which, with small modifications, serve as the foundation for the creation of additional processes and more specialized methods for the manufacture of differentiated products. The production process starts with the selection of suitable cells for the first culture. These cells will subsequently divide and turn into muscle tissue, which will continue to grow in size and quantity. This stage should be performed in suitable bioreactors with suitable culture media, nutrients, growth agents, and a support grid or other ways to promote growth. Thin sheets of muscle tissue that can be stretched and layered to produce a three-dimensional structure are the ultimate product (Chen et al., 2022).

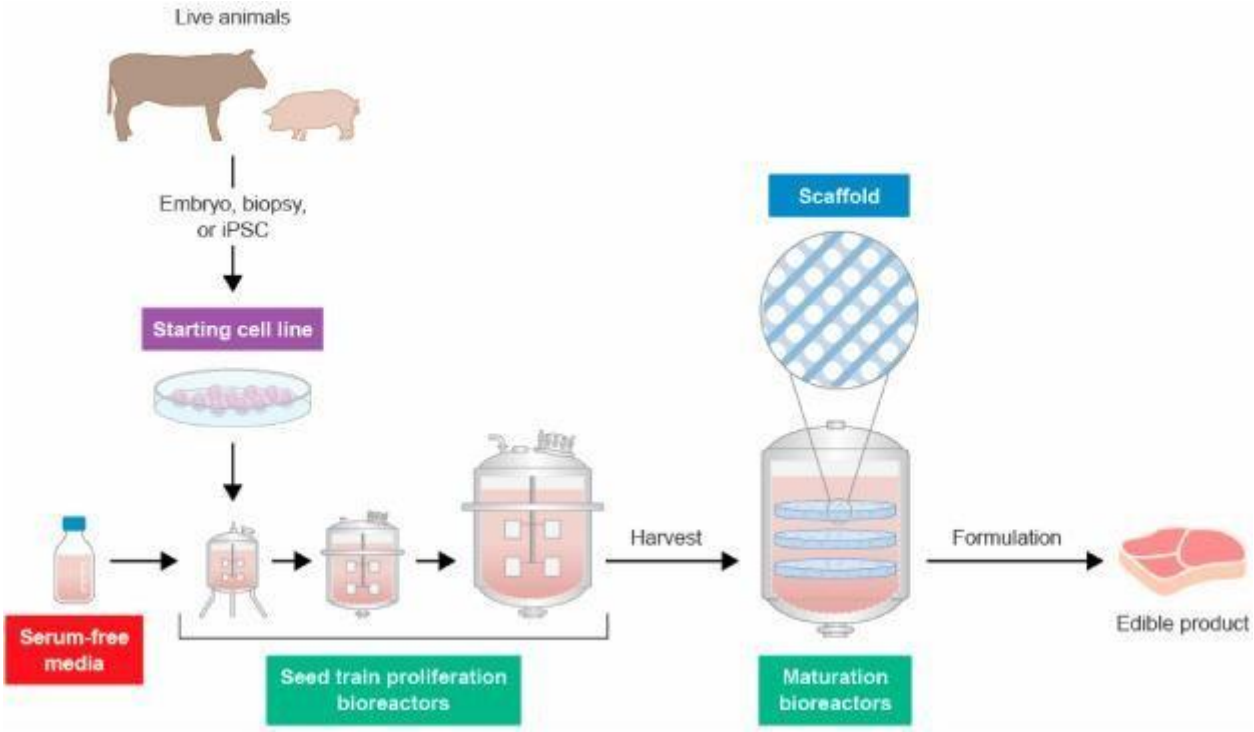

Figure 2.3: The process of making cell-cultured meat, from the cells to the finished product that is shaped (Chen et al., 2022).

(https://www.sciencedirect.com/)

Expanding the volume of an animal-derived muscle tissue graft is an alternate technique for producing 3D products. By growing in a culture media, Benjaminson, Gilchriest, and Lorenz (Benjaminson et al., 2002) were able to increase the surface area of a fish explant. However, due to dispersion constraints, it is unclear whether this technology will be effective in mass manufacturing. Additionally, it necessitates the use of complete tissues rather than simply cells for the initial cultivation, which presents challenges to their security.

The following are the primary production phases:

- Cell selection and early cell preparation.
- Choosing the right culture medium and other components
- Choosing an appropriate support system and combining it with the chosen cells, culture medium, and bioreactor
- Conditions for the bioreactor and the culture are chosen and set up.

The manufacture of cell-cultured meat begins with the selection of starting cells. Although meat is a complex combination of many kinds of tissue, the majority consists of muscle and fat tissue [for a standard hamburger, it is estimated to be 87.5% muscle and 12.5% fat tissue (Afshari et al., 2017)]. Therefore, the initial population chosen should be capable of proliferation and differentiation into muscle fibers and adipocytes. Satellite stem cells are the primary kind that can be generated for muscular tissue. Mesenchymal stem cells, embryonic stem cells, and induced pluripotent stem cells are alternatives (Kadim et al., 2015). By performing a biopsy on a donor animal or by using cell lines, these cells may be acquired (Stephens et al., 2018).

Cell lines are generations of cells formed from a subculture that may be genetically or chemically altered to achieve immortality, preventing them from almost endlessly proliferating (Ramboer et al., 2014). They may also be produced by choosing cells that exhibit spontaneous mutations and immortality for continued culture. Although choosing such continuous series would eliminate the need to regularly collect new animal tissues, their use comes with a number of drawbacks, including the need for special cell preparation for subcultures and passages, the accumulation of mutations, the difficulty of identification, and the potential for infection (Zhang G. et al., 2020). Furthermore, since these lines are continually changing and displaying changes in factors like growth speed, they could no longer reflect the original donor (Stephens et al., 2018).

To get cells from live animal tissues, it is vital to establish a biopsy technique that yields the required number of starting cells to begin the culture. Depending on the kind of target cell, numerous characteristics relating to the capture site, the animal's age, and the quantity of original tissue must be considered. A sample of beef muscle tissue, for instance, may be obtained using either a biopsy needle or a tiny incision. In the first instance, a dosage of around 0.5 g provides the animal minor pain and may be administered swiftly and simply. The sample size may not be adequate or representative. In the second scenario, 15 g is achieved and the process is more regulated, but it is also more time-consuming and intrusive (Melzener et al., 2021).

2.3.4 Insect-based protein

In the next 29 years, the population is projected to increase to 9.8 billion, creating a significant requirement for food supply to meet consumer demand. The Food and Agriculture Organization (FAO) has been publishing studies on edible insects and their potential for use in the production of food and feed since 2013. The terms entomophagy and, more recently, anthropo-entomophagy have been used to describe how humans consume insects. The first is also used when animals consume insects (Chow et al., 2021; Costa-Neto & Dunkel, 2016).

Insects provide benefits for the environment, economy, and nourishment. Some benefits include reduced greenhouse gas emissions, feed conversion, little effect on land regions, and the capacity to transform low-value organic by-products into high-value protein products. Some bug species may be raised organically, lowering environmental pollution and converting the excrement into organic fertilizer or animal feed. High protein percentages in the feed give it the potential to take the place of more costly complex feed components like fishmeal. To put the concept into reality with a mass raising facility that is effective, automated, and built inexpensively, with the end product being a safe product (Gómez et al., 2019).

Coleoptera (19 families and 467 species), Lepidoptera (29 families and 296 species), Hymenoptera (6 families and 268 species), Orthoptera (9 families and 219 species), Hemiptera (140 families and 80,000 species), Isoptera, Diptera (roughly 124 thousand species), and the leaf-eating Odonata are the orders of insects that humans consume worldwide. Beetles from the order Coleoptera, caterpillars from the order Lepidoptera,

wasps, bees, and ants from the order Hymenoptera, grasshoppers and crickets from the order Orthoptera, cicadas, leafminers, and true bugs from the order Hemiptera, termites from the order Isoptera, flies from the order Diptera, and dragonflies from the leaf-eating Odonata make up the (Costa-Neto & Dunkel, 2016; Pal & Roy, 2014).

It is still widely acknowledged that proteins extracted from insects constitute a high-quality food source. Due to the variability in nutritional content of the various species documented, many publications concentrate on the nutritional value of insects without allowing generalization of their worth as a whole. In the end, the contributing variables lead to variations in the nutrition of each insect under study. The nutritional value of the insect composition can be impacted by the species, sex, diet, type, development stage, environmental factors like temperature, day length, humidity, light intensity, and spectral composition, as well as preparation techniques (boiling, frying, baking, or drying) before consumption and processing techniques (Akhtar & Isman, 2018; A. Van Huis & Dunkel, 2017; Arnold Van Huis, 2013).

In addition to several vitamins and minerals (calcium, iron, zinc, and phosphorus), insects also include proteins, carbs, fatty acids, and fiber (vitamin A, B complex, C). The proteins, which are also the topic of the thesis, are given more significance as a result. Methionine, cysteine, lysine, leucine, tryptophan, valine, and threonine are essential amino acids that have been extracted from insects. By dividing the quantity of nitrogen by 6.25, or the crude protein content, one may calculate the protein content of an insect. Care must be taken to avoid overestimating the insect's true protein content due to the existence of other molecules with nitrogen content, such as chitin (a polymer found in the exoskeleton). For a variety of insects, it is advised to utilize the protein conversion factor of 5.60 rather than the standard ratio of 6.25. (Hawkey et al., 2021). The amino acid makeup and the food's protein content's digestibility both affect the nutritional value of proteins. The most important factor to consider when assessing the quality of food is the amount of essential amino acids (Costa-Neto & Dunkel, 2016; Gómez et al., 2019; A. Van Huis & Dunkel, 2017; Arnold Van Huis, 2013).

By taking into account the source's nutritional value, it is reasonable to compare each bug species' protein content percentages to the percentages of traditional sources. When evaluating entomophagy, the protein content of an insect is very significant. The findings will indicate whether or not the decision to isolate proteins from insects was wise (Akhtar &

Isman, 2018). **Table 2.3** provides a few instances of insects with high protein content and amino acids.

Table 2.3: The percentage of dry weight that is protein and amino acid in certain insect orders' edible insects (Chen et al., 2022).

Order	Protein			Amino acids			Necessary amino acids			N amino acids/ amino acids		
	high	low	ave.	high	low	ave.	high	low	ave.	high	low	ave.
Ephemeroptera			66.26			65.97			23.81			36.09
Odonata	65.45	46.37	58.83	51.70	36.10	46.03	19.08	13.04	16.12	36.91	34.05	35.69
Isoptera				58.27	33.96	44.03	20.88	12.77	16.74	40.05	35.73	38.04
Orthoptera	65.39	22.80	44.10	57.51	20.23	38.87	19.92	7.98	13.95	39.45	34.64	37.05
Homoptera	57.14	44.67	51.13	53.19	32.59	42.45	21.92	12.38	16.34	41.21	35.42	38.21
Hemiptera	73.52	42.49	55.14	59.68	38.09	48.72	22.18	14.73	18.65	42.72	34.77	38.41
Coleoptera	66.20	23.20	50.41	62.97	13.27	39.74	28.17	4.45	17.13	50.49	26.65	42.79
Magaloptera			56.56			53.31			19.51			36.60
Lepidoptera	68.30	14.05	44.91	61.84	13.27	32.88	25.60	4.45	13.92	47.23	26.65	40.35
Diptera			59.39									
Hymenoptera	76.69	12.65	47.81	81.27	21.0	45.18	33.62	8.42	16.23	46.41	30.56	35.78

2.3.5 Algae-based protein

In both freshwater and marine habitats, a diverse collection of unicellular photosynthetic microorganisms is known as microalgae (Barros de Medeiros et al., 2021). Depending on their class and species, they may be as little as a few micrometers or as large as several hundred. They typically grow in an aqueous environment with the availability of nutrients and carbon dioxide (CO2), and their cellular structure is less developed. As a result of these photosynthetic systems, solar energy is effectively converted into biomass by photoautotrophic means (Kratzer & Murkovic, 2021). By transforming nutrients from human emissions, such as ammonia and carbon dioxide, into macromolecules with added value, such proteins, microalgae may proliferate (Amorim et al., 2021).

Microalgal proteins are present in the cell's cytoplasm, organelles, plastids, cell walls, and nucleus, among other places (Amorim et al., 2021). The fact that different species of microalgae have been discovered to have protein contents between 40% and 70% is a key

factor in identifying them as an alternate source of proteins (Soto-Sierra et al., 2018). The cyanobacterium Arthrospira can contain up to 70% protein (Saadaoui et al., 2021), the high content compared to conventional sources (e.g., 55-70% for S. platensis and 42-55% for C. vulgaris per dry matter (Barros de Medeiros et al., 2021), and the quality of amino acids highlighted the importance of microalgae biomass and helped their inclusion as a potential ingredient in the (Barros de Medeiros et al., 2021)

Microalgae are seen in a number of industrial processes, including those that produce biodiesel, bioremediate liquid waste, make animal feed, and produce food. The final two categories are given greater weight in the thesis. Microalgae biomass and its derivatives (extracts and isolated chemicals) are used in a variety of ways, such as natural colorants and preservatives, with the goal of enhancing food quality and consumer health while also enhancing the technical components of the goods (Barros de Medeiros et al., 2021).

Prokaryotic cyanobacteria and eukaryotic microalgae (the diatoms that live in the seas), as well as several freshwater species of green microalgae, are noteworthy microorganisms for their industrial applications. Arthrospira platensis and Arthrospira maxima, two well-known Spirulina species, are cyanobacteria (Cyanophyceae or blue-green algae) (or Spirulina platensis and Spirulina maxima). Commercially significant freshwater green algae include Haematococcus pluvialis, which is a source of astaxanthin, Chlorella vulgaris, which is used as a food or nutritional supplement, and Dunaliella salina, which is a source of beta-carotene. (Murkovic & Kratzer, 2021) The most extensively grown species are Chlorella vulgaris and Spirulina platensis (Barros de Medeiros et al., 2021).

Due to their many benefits, microalgae have attracted the attention of industry. The capacity to develop quickly, use simple culture methods (solar radiation, water dioxide, and inorganic fertilizers), and endure harsh environments (Barros de Medeiros et al., 2021). They are regarded as a representative source of undiscovered chemicals with novel and intriguing uses, the main advantage being the improvement of consumer health. One of the examples is boosting the immune system, which will eventually help cut down on the use of antibiotics in aquaculture and cattle. Bioactive peptides with anti-oxidant, anti-hypertensive, anti-coagulant, anti-cancer, and immunomimetic properties are also produced by microalgae (Sadaoui et al., 2021).

Using microalgae is not without its downsides. Among these are the most stringent regulations for quality, safety, and environmental impact minimization. The primary

drawback of the alternative source is the greater cost of operation, infrastructure, and maintenance of the facilities necessary for the growth and extraction of biomass, the selection of the protein source strains, and the commercial harvesting and dehydration. For an accurate evaluation of the potential of these microorganisms, the financial market and the dependability of data on microalgae marketplaces are cited as limiting issues (Barros de Medeiros et al., 2021).

3. CONSUMER BEHAVIOR

The food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) advocated the establishment of food-based dietary recommendations in 1992. (FBDGs, Food-Based Dietary Guidelines). Dietary recommendations based on food seek to compile a database of food, nutrition, health, and agriculture-related public concerns and policies. In addition, the establishment of nutrition education initiatives to encourage healthy eating and living behaviors. Lastly, they give food and nutritional advice on vital nutrients to the general population for the promotion of health and avoidance of chronic illness (Bechthold A. et al., 2018; FAO, 2018)

Dietary recommendations for Greece were published in 1999 with the presentation of a food pyramid (**Figure 3.1**), which is based on the pattern of the Mediterranean diet. The pyramid has three tiers. In the first level, foods such as whole grains and goods, fruits, vegetables, olive oil, and dairy products are consumed daily, while in the second level, foods such as fish, poultry, olives, legumes, dry fruits, potatoes, eggs, and sweets are consumed weekly. Finally, at the summit of the pyramid, connected to monthly intake, is red meat. However, representations of physical activity and the prescription for moderate wine drinking can be seen all throughout the pyramid (FAO, 2018).

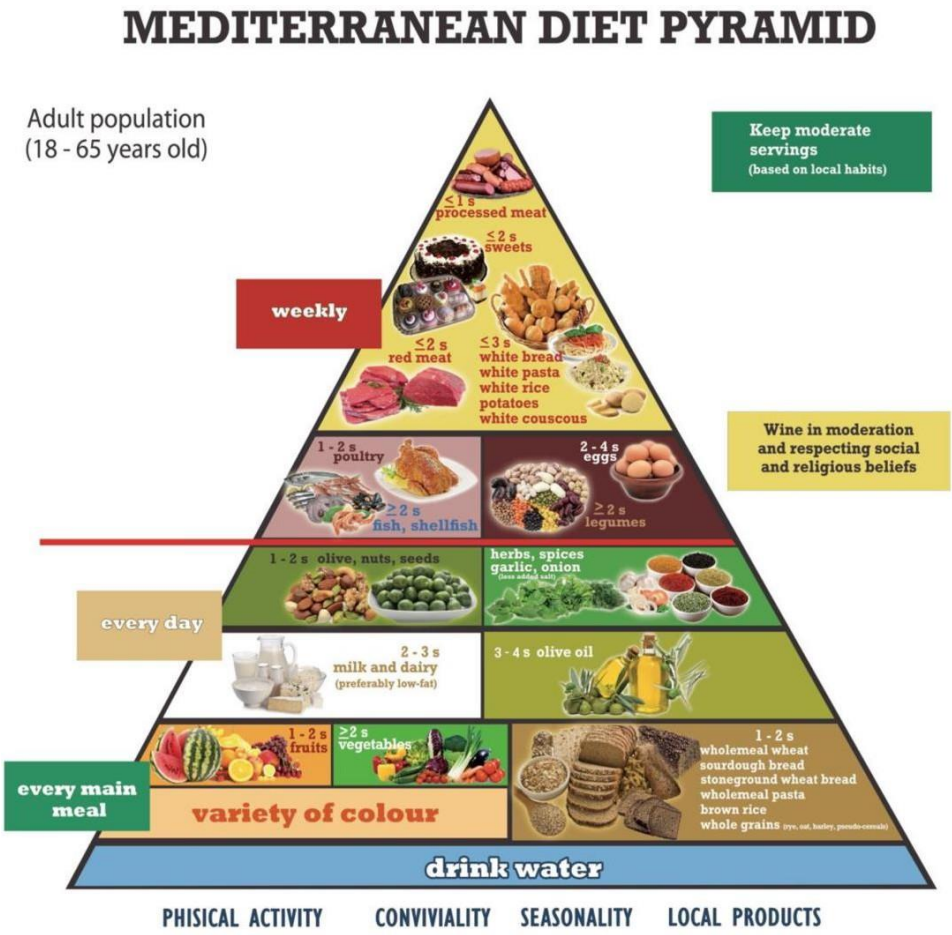

Figure 3.1: Mediterranean Diet Pyramid (D'Alessandro et al., 2019).

(https://www.mdpi.com/)

The current European FBDGs now allude to sustainability as the fundamental principle that should guide the different dietary patterns, but they also emphasize the shift to eating habits that mostly consist of items with a plant origin. The literature lists a number of dietary regimens that are good for human health and are less harmful to the environment, including the DASH Diet (Dietary Approaches to Stop Hypertension), the Mediterranean Diet, and the Scandinavian Diet (Magkos F. et al, 2019).

The DASH diet is defined mostly by plant items with the addition of certain animal products and a concentration of low-fat or skim-dairy products. In particular, the Mediterranean and Scandinavian diets place an emphasis on locally produced foods. Additionally, a high intake of plant foods and a low intake of foods of animal origin, as well as modest alcohol use, define the diets of the civilizations in the Mediterranean basin. Similar to the Mediterranean diet, the Nordic diet emphasizes a high intake of plant-based foods, nuts,

dairy products, fish, shellfish, and free-range animal foods. In conclusion, in terms of health, flavor, culture, and the environment, each of the aforementioned dietary patterns is regarded as a standard for omnivorous consumers (Magkos F. et al, 2019).

Although animal products may be included in a diet that emphasizes plant-based meals, plant-based foods must constitute the foundation of the diet. The World Cancer Research Fund (WCRF), which advises eating two-thirds of a meal made of plant-based foods and one-third of it made of animal products, supports this as well (WCRF/AICR, 2007).

3.1 Eating habits - Types of consumers

Based on the degree of divergence of the goods, the diet is classified as semi-vegetarian, vegetarian (lactose-free and/or egg-free), and fully vegetarian. Thus, vegetarians may be split into the following fundamental groups:

- Lacto-ovovegetarians, abstain from eating meat, fish, and shellfish yet consume dairy and eggs.
- Lactovegetarians, abstain from consuming meat, fish, shellfish, and eggs, but consume dairy products.
- Pescovegetarians, abstain from eating meat but consume dairy, eggs, fish, and shellfish.
- Semi-vegetarians (Semi-vegetarians, Flexitarians), sometimes take fish, shellfish, and meat in addition to dairy products and eggs.
- Vegetarians (Vegans), abstain from all animal products, including meat, fish, shellfish, dairy, eggs, and honey (BDA, 2018).

Semi-vegetarians often referred to as "Flexitarians" in international literature, are the target market for alternative sources of proteins, particularly those derived from plant sources, which are denoted by the phrase "plant-based" (Derbyshire E. J., 2017).

Specifically, "Flexitarians" is a novel name that blends the concepts of flexibility with vegetarianism, meaning that members of this group maintain a vegetarian diet with occasional meat and/or fish eating (Oxford English Dictionary, 2014). Individuals who seek to minimize their use of meat and animal products are reflected in the semi-vegetarian trend. In other words, they sometimes consume animal proteins because they realize that they are

sources of other vital nutrients, but they also consider the health of the environment and their own well-being (Derbyshire, E.J., 2017).

The Cambridge Dictionary's definition of the adjective "plant-based" is that it refers to anything that is produced totally or mostly of plants (Cambridge Dictionary, 2018). A "plant-based" diet, on the other hand, comprises a vegetarian or a fully vegetarian diet (vegan), according to the American Association of Dietitians (Academy of Nutrition and Dietetics) (Melina V. et al., 2016). A "plant-based" diet is one that is centered on plant foods, such as vegetables, fresh fruits, seeds, and grains, with little to no animal products, according to the British Dietetic Association (BDA, 2018).

The term "plant-based" diet has been defined in a number of different ways in the literature. According to Ostfeld, R.J., 2017, it is a diet that excludes all animal products, including red meat, chicken, fish, eggs, and dairy products, and is based on minimally processed fruits, vegetables, whole grains, legumes, nuts, seeds, and herbs and spices (Ostfeld, R.J., 2017). However, there are additional classifications that include meals derived from animal origins. For instance, the Danish group "Danish Vegetarian Union" states that a "plant-based" diet consists of whole, unprocessed plants, fruits, vegetables, legumes, nuts, seeds, and grains with the inclusion of modest quantities of processed items and/or animal products (Dansk Vegetarian Forening, 2019). A "plant-based" diet, according to the "Alpro" organization, consists of 70% plant-based meals and 30% animal-based foods (Alpro Foundation, 2015).

3.2 Consumer influences

The acceptance or rejection of a different protein source is greatly influenced by consumers' eating patterns and habits. Consumers are more open to alternative proteins made from plants than alternative proteins from animals. 91 papers stressing consumer acceptability of alternative proteins from five distinct sources of origin—legumes, other plant proteins, insects, algae, and cell-grown meat—were found in a comprehensive review by Onwezen et al. (2021). They agreed that consumers find alternative proteins more challenging to accept than meat. Proteins derived from plants, whether they come from legumes or other plant-based foods like grains, nuts, fruits, or vegetables, are more easily assimilated than proteins from animals. This study identifies quality, organoleptic character, nutritional value,

health impact, familiarity, nutritional neophobia, and social norms as the driving forces behind the adoption of a class of alternative proteins. The impact of each component on the consumer's perception, however, varies. For instance, the adoption of insects as an alternative protein source is influenced by familiarity as well as psychological processes that the consumer is exposed to, such as coping with their fear or dislike of insects (Onwezen et al., 2021).

A certain proportion of consumers acknowledge that they consciously choose to eat different proteins. This consumer group often comprises those who have chosen to follow a different diet in which eating meat is either fully avoided or consumed in moderation, such as vegetarians or vegans. In other circumstances, sources other than meat are used to supplement animal proteins, such as algae or legumes (Onwezen et al., 2021).

The primary variables that might affect a consumer's decision to purchase an alternative protein product are those related to the product itself, including its features and the savings it offers, human psychology, as well as societal or cultural traits (Onwezen et al., 2021).

3.2.1 Acceptance factors related to the product

Some of a product's features, such as its sanitary status, flavor, accessibility, possible environmental advantages, health benefits, and aesthetics, are directly tied to consumer acceptability. Addressing the choice and acceptance of alternative proteins by consumers, the link of overconsumption of meat with the environmental impacts and the rise of health issues is also essential. In order to adequately fulfill the demands of the global population, animal husbandry has been proven to have intensified as a result of the excessive consumption of meat. However, according to van der Weele et al. (2019), the quick growth of animal husbandry was connected to:

- The loss of biodiversity, the exploitation of ever-larger tracts of land, and the necessity to raise cattle or feed animals.
- The expansion of agriculture because animals require food to thrive
- The acceleration of climate change as a consequence of the increasing generation of gaseous pollutants (mostly CO2 and CH4).

- The excessive water use brought on by a rise in livestock and agricultural activities (watering animals, cleaning livestock units, irrigation).
- the overuse of animals, which results in the terrible treatment and living circumstances of animals.
- The evolution of bacteria resistant to antibiotics. In addition to treating or preventing infections, antibiotics are used in animal husbandry to improve the weight of animals. Since 2006, the use of antibiotics as growth factors has been prohibited in the European Union, yet the intake of antibiotics by farm animals has grown.

In addition, excessive meat intake was linked to the development of various human ailments, including hypercholesterolemia, cardiovascular disorders, and even an increased risk of carcinogenesis, such as colon cancer (van der Weele et al., 2019). In addition, there are some criteria set by the customer, such as certain dietary restrictions or needs. Thus, a customer accepts alternative proteins more readily if, for instance, he has chosen a more or less rigorous vegetarian diet, or if there are medical reasons, such as allergies or intolerances to certain animal components (Onwezen et al., 2021).

Motivations for recurrent intake of a product containing alternative proteins are notably different from those for first ingestion. For instance, in a study conducted by House (2016) in the Netherlands on the low acceptance of insect consumption in the Western world, at the initial test, the factors affecting the consumer were primarily psychological (fear or disgust, curiosity), but repeat consumption was more related to product attributes like price, marketability, easy access, and taste (House, 2016).

One of the most influential variables in the adoption of alternative proteins is familiarity, or the individual's predisposition to imitate similar behaviors and make familiar choices. Acceptance of goods based on legumes, insects, algae, or cultured meat needs experience with these items since their organoleptic features (taste, texture, and appearance) are often novel and not always readily available (Onwezen et al., 2021).

A study was done in the USA by Woolf et al. (2019) to determine the elements that affect customers' willingness to try insect cuisine. The findings indicated that prior consumption of an insect-containing product (familiarity) and knowledge of the negative health impacts of insectivory significantly affected desire to try. 7.8% of the participants routinely or rarely ate bug meals, whereas 74.1% of the participants had never tasted insect-based goods. The majority of survey respondents (67% of those without prior experience)

who had never tried eating meals containing insects indicated they found the notion of eating insects unpleasant. A somewhat smaller proportion of customers (35%) who had at least tried it once expressed opposition to eating insects (Woolf et al., 2019).

3.2.2 Social factors

The social milieu, the consumer's cultural background, and the consumer's level of trust may all have an impact on the acceptability of goods made using alternative proteins. There is a link between trust and acceptance of protein-based diets, according to studies. If an area exhibits skepticism about science, acceptability is diminished. If an official organization, such as a public health institution, demonstrates its support for a product and tells the public about it, customer trust and acceptance will improve (Onwezen et al., 2021).

The societal standards and social norms that develop a certain behavior and attitude toward an invention or alternative solution are also crucial. According to the research by Figueira et al. (2019), the unfavorable opinions of family and friends regarding legumes worked as a barrier to the consumption of meals containing certain alternative bean proteins (Figueira et al., 2019). Also, Sogari et al. (2016) found in a study that the social context has a substantial effect on the suggestion to try dishes containing insect components (Sogari et al., 2017).

The cultural traditions of a population are a significant impact on their acceptance or rejection of alternative protein products. China, for instance, is an ideal area for the creation of insect-based products since insects are already a part of Chinese culture (Onwezen et al., 2021).

3.2.3 Psychological factors

Alternative protein consumption is influenced by consumer behavior, including attitude, food fear, and aversion (Onwezen et al., 2021). The adoption or rejection of new alternative items is strongly influenced by the attitude a customer maintains toward them. According to studies, people who have already made up their minds to dislike items made from alternative protein sources are less likely to buy them and, even after a first test, find that they perform better than expected (Lombardi et al., 2019). Additionally, it becomes more

difficult to credit a food containing alternative proteins the more consistently and positively someone consumes meat (Hoek et al., 2011). Family and friends are often an emotional motivator for the intake of novel protein alternatives since negative feedback from them might result in the development of a negative attitude (Onwezen et al., 2021).

The avoidance of or unwillingness to try new foods is referred to as food neophobia. There is often a concern for the product's safety or the consumer's health when alternative proteins made by microorganisms are consumed. Aversion, the sensation of disgust, often acts as a deterrent to the eating of foods derived from insects and, to a lesser degree, from algae (Onwezen et al., 2021).

4. INDUSTRY & ALTERNATIVE PROTEINS

4.1. European legislation

Regulation (EU) 2015/2283 defines "novel foods" in the European Union (EU) as foods that were not extensively eaten by EU inhabitants prior to May 15, 1997. Additionally, novel foods refer to either food sources or those that are newly created and inventive, as well as those that are produced utilizing new technology and production techniques, as well as those that are usually eaten outside of the EU. The general labeling requirements imposed by Regulation (EU) No. 1169/2011 apply to new foods. Specifically, the product label must include the name of the item, the instructions for use, and any nutrition or health claims must be consistent with the regulation on strict nutrition and health standards (EC) no. 1924/2006. Regulation (EU) 2015/2283 on innovative foods applies to insects, algae, and in vitro meat, as well as other alternative protein sources (European Union, 2015; European Union, 2006; European Union, 2011).

Moreover, Regulation (EU) No. 1308/2013 defines the common structure of agricultural product markets. Article 78 of the Regulation specifies that Annex VII contains terminology and naming conventions (such as definitions, names, and sales descriptions) for the different sectors and goods meant for human consumption, such as meat, milk, and milk products. Part III of Annex VII reserves the terms’ milk,' 'cheese,' 'yogurt,' and 'butter' for goods containing

dairy milk (defined as "...the secretion from a normal mammalian animal, collected from one or more milk without addition or extraction"). This legislation does not, however, permit the sole use of the names "steak," "sausage," "escalope," "burger," and "hamburger" for goods containing meat of animal origin (European Union, 2013).

In October 2020, certain members cast their final votes on amendments 171 and 165 on the use of the terms "milk" and "meat" for plant products, respectively, in order to change specific sections of Parts III and I of Annex VII of application (EU) no. 1308/2013. Interestingly, distinct stances were taken by MEPs on two identical ideas (European Union, 2013).

MEPs specifically rejected amendment 165, which revised Part I to prohibit the use of terminology like "steak," "sausage," "escalope," "burger," and "hamburger" for plant-based goods (vegetarian) and totally vegetarian diets. MEPs chose to support amendment 171, which changes Part III to prohibit the use of words like "vegetarian cheese," "butter style," "yogurt style," and "cheese style" for non-dairy products. Furthermore, unlike plant-based meat replacements and meat products, alternatives cannot use names connected to meat from animal sources, although they are permitted to use terms relating to dairy products (European Union, 2013).

The voting on Amendment 171 follows a 2017 New York State Supreme Court decision that prohibited the use of dairy words such as "milk," "butter," "cheese," and "yogurt" for pure plant-based products (tofu), with the exception of coconut milk, peanut butter, almond milk, and ice cream. The European Dairy Association hailed the result, adding that "non-dairy products cannot breach dairy terms and the perfection of milk and its products." Opponents of Amendment 171 argue that the prohibition looks to be in conflict with the aims of the Green Deal and the Farm to Fork Strategy, which seek to develop healthier and more sustainable food systems (European Union, 2013).

In order to avoid consumers misrepresenting vegetarians and pure vegetarian items, the European Commission finally decided to register the European Citizens' Initiative in 2018 with the title "Mandatory labeling of food products: "Non-Vegetarian/Vegetarian/Pure Vegetarian." of animal origin, who find it difficult to locate suitable food products (European Union, 2018).

4.2 Global alternative protein industry

In 2016, the worldwide market for protein ingredients was valued at USD 31.8 billion and is projected to reach USD 46.4 billion by 2022, expanding at a CAGR of 6.5%. Proteins derived from plants are projected to account for one-third of the total amount of protein eaten in 2054. (Allied Market Research, 2018).

More specifically, the market for plant-based meat alternatives was estimated to be worth USD 12.1 billion in 2019 and is anticipated to increase at a CAGR of 15% over the following six years, reaching almost USD 28 billion by the year 2025 and USD 85 billion by 2030. (UBS, 2019). Frozen meat substitute goods in particular, with a market share of 77.2%, were the most popular worldwide in 2017 when compared to the other alternatives in the refrigerator or on the shelf (Markets and Markets, 2020). Also, according to A.T. Barcla, a financial services corporation, the alternative markets industry will increase from 1% of the worldwide market share in 2019 to 10% by 2029, with a market share of $140 billion (A.T. Barclays, 2019).

On the other hand, it is anticipated that by 2024, sales of plant-based milk replacements would surpass $3 billion. The worldwide market for these products reached $21 billion in 2015. oat, almond, and coconut milk with soy. Additionally, during the next ten years, the worldwide market for plant-based cheese, yogurt, and ice cream alternatives is anticipated to grow to around $4 billion, $12 billion, and $2.4 billion, respectively (Future Market Insights, 2020; Markets and Markets, 2020).

At a CAGR of 5.8%, the alternative egg market's worldwide value could surpass USD 1.5 billion by the end of 2026. Due to the relatively low levels of competition in the plant-based egg replacement market, dry egg substitutes are not growing as quickly as other types of egg substitutes in the business (Markets and Markets, 2020). Additionally, a CAGR of 8.7% is predicted for the worldwide market for plant-based snacks, which will increase from $31.8 billion in 2018 to $73 billion by 2028. (Future Market Insights, 2020).

In 2019, the greatest market for plant-based meat replacements is in North America, followed by Europe, Asia, and the rest of the Pacific. In addition, similar market shares by region are anticipated for the year 2025. Due to the growing expense of dairy-based products and dietary choices based on religious and ethical values, the market trends in these areas are turning toward less expensive plant-based alternatives. Still, other industry trends include the growing demand for functional meals and drink to shift consumers' spending power toward healthier eating alternatives (Statista, 2020).

Specifically, in Western Europe, the market for veggie alternative goods has quadrupled since 2012, and the European market for meat substitutes will increase from 1.5 billion in 2018 to 2.4 billion by 2025, representing almost 40% of the worldwide market. In contrast, the market for plant-based meat replacements in the United States reached $4.5 billion in retail sales during 2018-2019, an increase of 11%. In many product categories, such as dairy products, plant-based alternatives greatly outperformed the rise of traditional animal-based goods, resulting in decreased sales of yogurt and milk. In terms of sales, vegetable alternatives to fish do not surpass 10 million dollars (ProVeg, 2019).

Asia, Latin America, and Africa will have smaller economies than European nations by 2050, with 1.5 billion and 0.8 billion USD, respectively. According to Mintel, Asia is the emerging market for alternative protein staples in 2018, as plant-based yearly creams have increased by around 15% between 2014 and 2018. In addition, the Asian market will not account for 73% of plant-based seafood replacements by 2025 (Mintel, 2018).

4.2.1 Plant-based dairy & meat products

Despite the rise of the worldwide market for alternative plant-based goods, the market for alternative plant protein products is still in its infancy and thus provides great room for additional expansion and new entrants. The global availability of herbal alternative products is expanding not only due to the creation of new products and components but also due to rising customer demand (Allied Market Research, 2018).

According to Deloitte, 2019, the worldwide market for alternative protein products is attracting investor attention, with the most discussed topics included in Table 4.1 below. Individuals, investors, and food and beverage companies are seeking to join or develop in the rapidly expanding market for alternative plant protein sources, which provide better yields than other food categories. However, there is also a tendency toward company consolidation in the plant-based food business, as purchasers attempt to enhance synergies with enlarged portfolios and market expansions (Deloitte, 2019).

In addition, since the industry activity around alternative plant-based ingredients develops and the sector is in its early phases of development, there are a large number of start-ups and relatively small enterprises wanting to increase their capital.

Notable is the fact that over the last decade, over 16 billion dollars have been invested in American firms producing plant-based or in vitro alternative meats, with 13 billion dollars invested between 2017 and 2018. (Deloitte, 2019).

Two sales methods are being evaluated internationally in the area of plant-based protein meals. In the first scenario, the product is provided via menus at restaurants and fast food chains, such as Impossible Foods, whereas in the second scenario, it is sold through retail outlets like the goods produced by the business "Beyond Meat." It's important to note that in the second instance, the product from Impossible Foods is priced $1 more at Burger King than the same product from the business Beyond Meat, which was previously only accessible in retail outlets as a "luxury" protein product.

Additionally, because 35% of all dairy products are ingested indirectly via other food items, this is the main area where substitute sources for animal proteins should be focused. Companies like Califia Farms, which committed $225 million to speed up the expansion of its production capacity in order to satisfy the rising demand for dairy alternatives, are examples of how this is already taking place.

Due to the difficulties of creating protein structures that are equivalent to those of traditional meat, the first commercial in vitro meat products is more likely to be offered via restaurants in the market and to be mostly ingredients rather than full items. The $161 million Memphis Meat Company factory in California is the world's first commercial meat-producing facility. (Deloitte, 2019; Sworder, C., 2019) Other businesses, including "Mosa Meat" and "Aleph Farms," are engaged in the production of goods made from in vitro meat. A restaurant in Singapore recently began serving in vitro meat "chicken bites" (Figure 2.4) that were produced in a bioreactor by the American business Eat Just (Carrington D., 2020).

In a recent analysis, RethinkX predicted that by 2030, replacements will account for 50% of the beef and dairy industries' earnings in the United States. As a result, the meat and dairy sectors use a variety of strategies to stay competitive (RethinkX, 2019).

The level of market demand for herbal goods is far higher than the existing, restricted supply, hence competition between them is often modest but growing quickly. On the other hand, the rivalry for capital investment is greater for in vitro meat firms since a number of stakeholders are attempting to make the switch to manufacturing techniques that lower production costs and make a final product more cheaply accessible to customers.

European merchants are expanding their product quality in response to the rising demand for meat replacements made from plants. For instance, in 2019 the UK shops "Greggs," "Marks & Spencer," "Tesco," and "Aldi" all introduced plant-based product lines. As part of the worldwide Veganuary movement, the British bakery chain Greggs launched a plant-based sausage in January and experienced a 9.6% sales boost, while Marks & Spencer introduced plant-based products under the "Plant Kitchen" brand in December 2018 and expanded with additional plant-based traditional meals in October 2019. Tesco has released another plant-based line called "Tesco Plant Chef" that has vegetarian spaghetti and pizza in addition to new plant-based meat alternatives for its "Wicked Kitchen" line that have been added to the regular meat department. Finally, the UK's Aldi grocery chain has started carrying a line of Mae's Kitchen plant-based meat products.

With 10% of the population following a vegetarian diet, Germany has one of the highest vegetarian prevalence rates among European nations. It has particularly improved the legal climate in favor of herbal items and their labeling. The aforementioned factors all play a role in the market for herbal alternative goods in Germany expanding quickly (ReportLinker, 2020).

4.3 Alternative protein industry in Greece

In the last two decades, plant-based alternatives to dairy products have been available on the Greek market, but without the desire of consumers, since they were mostly used during the fasting season for religious reasons or as an economical alternative to animal goods (Vegan Times, 2020).

However, it seems that as Greek consumers become more interested in new and healthier food alternatives, their preferences are shifting with time and transforming the food and beverage business. The vegetarian diet appears as one of the seven trends for the decade of 2020–2030, according to a recent study by IELKA (Consumer Goods Retail Research Institute) for the Greek region. While 25% of respondents believe plant-based foods to be healthier than animal products, just 3% of Greeks identify as vegetarians, compared to 15% in other European cities like Sweden. However, 62% of respondents said they had increased their diet of fruits and vegetables. Finally, it is said that a consumer public has already developed in Greece, which favors plant-based goods and tends to form a proportion of 40%, and it is likely

to pay a greater price for items, which have been manufactured using environmentally friendly procedures (IELKA, 2019).

According to Nielsen, in 2018 there was a rise in the consumption of plant-based dairy alternatives in the Greek market. More precisely, from the year 2018 to the month of January 2019, there was an increase in the volume of sales of plant-based dairy alternatives by 72%. Dairy firms or other food and beverage businesses dominate the market in Greece for this product category (Nielsen, 2018).

Prior to 2017, Greek consumers could only purchase plant-based dairy alternatives from foreign firms like "Alpro" and "Provamel." Today, however, there are numerous choices available from Greek businesses as well.

One of the first Greek businesses to invest in expanding its product line with plant-based dairy alternatives was the firm "Olympos." In comparison to the same time in 2017, volume sales of these herbal beverages increased by 61.3% in the first nine months of 2018. Nevertheless, there was a little rise in sales between these two years as a result of ongoing promotions and incentives that stoked customer enthusiasm for buying.

Additionally, in 2018, it went on to deepen relationships with Central Macedonian suppliers of the herbal beverages' primary ingredients, including almonds and pistachios, where it already had synergies with farmers in Thessaly and Fthiotida. As a result, the network of producers was enlarged to 100, up from 80 in 2017. Finally, via "Afi Petrou," a local import business, the first shipments to Cyprus began in November 2018.

The company "Delta" also entered the market for plant-based dairy substitutes in the summer of that same year with four product codes, including plant-based almond drinks with and without sugar, tahini, and coconut, highlighting, in particular, the Greek locality of the first three products' raw materials (Anonymous, 2018).

Although there are several plant-based dairy alternatives on the domestic market, including milk alternatives, cheese, yogurt, and cream, there are currently just a few choices for plant-based cold meat and meat replacements. Additionally, a variety of foods, including sauces, desserts, pasta, coffee, eggs, etc., are now accessible in our nation's physical and online shops as vegetarian choices.

On the other hand, as more and more customers are shopping for such items at different retail establishments, the category of plant-based meat replacements in Greece has shown an upward tendency in recent years. Following this trend, more and more Greek producers

of meat and other animal products are diversifying their product lines to include plant-based alternatives. In addition, a variety of restaurants are expanding their menus to include meals that use plant-based meat replacements (Anonymous, 2019).

According to a market study conducted in 2019, there is an increasing demand for plant-based meat alternatives such as chicken nuggets, sausages, burgers, bacon, and schnitzels that can be conveniently stored in refrigerators at local retail locations in the Greek market. The first plant-based meat replacements were purchased in Greece via online marketplaces, but in more recent years, they have also been seen on grocery shelves (Anonymous, 2019).

Consumers who seek and finally acquire alternative meat products prefer to spend a higher price in order to receive a healthier product, as demonstrated by the purchasing pattern of these goods. Moreover, monitoring the prices of various items on the market reveals that vegetarian choices are more expensive than traditional ones. As a consequence, retail establishments have the chance for a bigger profit margin, as the price of the product is not a main consideration for this group of customers, who are used to spending more to assure product quality.

5. METHODOLOGY

5.1 Theoretical review

Numerous research on the issue of sustainability that results from the conventional production of animal flesh and its increased consumption globally have been published (Veldhuizen et al., 2020). It has been shown to be detrimental to both the environment and human health, with red meat consumption drawing the most ire (Wim de Koning et al., 2020).

The ideal circumstances for the development of substitutes for conventional proteins as well as an increase in the acceptability and acknowledgment of those that already exist were generated within the environment that was established. The demographic pressures and socioeconomic development patterns that support the growth of the new food market and the potential for their availability in numerous marketplaces should also be included in this data.

It's crucial to comprehend how consumers see animal meat as an essential component of their diet and way of life, as well as the potential for plant-based meat substitutes to influence their purchase and consumption patterns. According to Kush et al., 2019, the purchase habits of consumers don't usually change very quickly. Customers' resistance to altering their tastes is likely the result of an ingrained natural impulse designed to safeguard individuals from possibly harmful or improper foods. The consumer is already familiar with the meals they eat because they have qualities that support their health and development, but new foods are looked at with dread since they conceal hazards. Thus, there is an innate neophobic tendency to shun strange or new foods. This tendency has been socially formed and filtered via the system of long-term consumer preferences, as was the case with the initial introduction of plant proteins to the human diet (Wim de Koning et al., 2020).

Food neophobia, which is seen as a manifestation of a contradiction in consumer behavior with novel foods, might be used to define a portion of this behavior. The consumer's values, dietary choices, and nutritional neophobia may all have a big impact on how much protein they consume. Additionally, a major obstacle to replacing meat with plant-based alternatives is the aversion that may be brought on by neophobia toward alternative proteins (Wim de Koning et al., 2020).

By providing regular, extensive exposure to new foods and counseling, dietary neophobia for new items may be addressed, preventing people from scrimping on new foods and lowering their rejection. Therefore, it might be claimed that food neophobia's effects can change over time. Vegetable proteins must overcome substantial obstacles, according to Clark and Bogdan's study from 2019, in order to keep growing their market shares (Clark L., Bogdan A. 2019). However, the study discovered that once people start using plant-based substitutes, they are more likely to try subsequent plant-based protein sources that are comparable to them. Other studies, such as (Gómez-Luciano & Vriesekoop, 2019), support the aforementioned findings because, despite their hesitation to immediately adopt new foods, participants in those studies say they are open to future changes and support a gradual change in their diet that includes consuming more alternative proteins. These results concur with those of Van der Weele et al (2019).

5.1.1 Market response

Consumer perceptions of these new meals are recognized as one of the most significant barriers to consumers' willingness to acquire and include alternative plant proteins in their diet. According to Schouteten et al. (2016), the supply of information regarding alternative foods increased their acceptability compared to not giving this information. According to Backstrom et al. (2004), familiarity significantly impacts people's readiness to try a new product that they are unfamiliar with or have never experienced. As a result of an earlier study, unfamiliar items are met with skepticism and consumption barriers since they disagree with typical customer behavior. According to (Chang et al., 2019) and (Chang et al., 2019), highly processed foods and items with less authenticity seem to have a negative influence and lower purchase intent among customers (Eyhorn et al., 2019). Despite consumers' growing readiness to test novel food items, there is still a large price gap between animal meat and plant-based alternatives (Wim de Koning et al., 2020).

5.1.2 Food neophobia

Pliner and Hobden (1992) created the Food Neophobia Scale (FNS), which measures consumers' readiness to consume foods they may be unfamiliar with or are encountering for the first time in their lives. Cox and Evans (2008) extended the examination of food-related neophobia by examining the potential for consumers to be affected by new technologies used in the production of novel meals. This term has been dubbed "food technology and Neophobia." The Food Neophobia Scale and the Food Technology Neophobia Scale have both been extensively verified in a variety of settings. According to (Capitanio et al., 2010), customers' hesitation to eat new meals stems mostly from apprehension surrounding the components and manufacturing methods of an unfamiliar food product (Wim de Koning et al., 2020).

5.2 Questionnaire objectives

The major goal of this research is to determine whether or not vegetable proteins might realistically replace animal proteins and whether or not the target customer would accept them. It aims to provide a model that may be used to predict consumer attitudes about alternative animal proteins and their propensity to test, purchase, and pay more for these

goods. As they will be the ones to promote novel meals, it also tries to discover consumer profiles and their key traits.

The model was created using research that claimed novel meals had an impact on customer behavior. It was anticipated that customers' desire to explore, purchase, and pay more for alternative animal proteins would be hindered by food neophobia and nutritional food technology. Looking at how consumers' perceptions of suitability and alternative meat processing affect their perspectives on the value of flavor, texture, smell, and nutritional content of meat (Wim de Koning et al., 2020).

Suitability was described as a confluence of sensory advantages, dietary advantages, environmental advantages, and health advantages. It's also crucial to look at the significance it has in terms of health, as well as the likelihood that these aspects will change how people see alternative plant-based meats, leading to a greater readiness to eat them (Wim de Koning et al., 2020).

5.3 Research questions

The questionnaire aims to address a number of research queries that came up during the examination of the literature listed in earlier chapters and from the results of earlier studies, respectively. The questionnaire's other goal is to learn more about how consumers behave toward plant-based meat and dairy products that include plant proteins, including how willing they are to try, purchase, and pay for these novel alternative foods and what variables affect their choices.

Beginning with the demographic questions, an effort is made to determine how age influences the consumption choices of the research participants. This is because, according to the literature, older consumers tend to prioritize health, whereas younger consumers have been noted as being more influenced by environmental benefits obtained from the consumption of plant products, as well as by improvements to the quality of life and animal husbandry, which is also explained by the enviro (Ellen J. Van Loo et al., 2020). In addition, given financial position and educational attainment have been significant predictors of consumer choice for plant-based meat in the studies we have so far quoted, these aspects are intriguing to investigate. Other studies have shown that customers with higher incomes and levels of education were more likely to purchase and use herbal alternative items. 2020

(Ellen J. Van Loo et al). The location of the participants in the final demographic factor that requires research, as those who reside in urban areas is more likely to be willing to eat plant-based alternatives due to their proximity to stores carrying these products, increased familiarity due to access to more information, or even greater willingness to change (Bryant C.J et al., 2019).

The following is a list of the pertinent research questions for this study:

I. What are the dietary practices of consumers based on their age and location?
II. What are the primary factors influencing consumer adoption of plant-based products based on annual income?
III. Does influence consumer neophobia regarding attempting and adopting novel food products in relation to age, education, and income?
IV. Given their age, how likely is the consumer to pay a higher price for fortified plant-based protein products?

Following is a detailed description of the phases of the methodology employed in this particular study to address the aforementioned research issues.

5.4 Sample selection

In the current research project, a questionnaire was utilized to gather data. The questionnaire consists of a series of structured questions to which the respondent is required to reply in a specified sequence. Questionnaires are one of the most often used data collection methods in quantitative research since they offer an expedient method for collecting answers from a large sample prior to quantitative analysis.

In addition, the use of questionnaires offers several benefits, such as the ability to distribute them to a large number of individuals, simple, quick, and inexpensive ways, uniform responses, the absence of direct contact, as well as the ability to influence responses. On the other hand, it has several downsides, such as requiring respondents to answer in a particular manner and making it harder for the researcher to explain open-ended questions (Saunders, M. et al., 2007; Choudhury A., 2019).

The decision to employ questionnaires in this specific study stems from the need to gather data and comprehend the correlations between the many factors, in contrast to comparable

studies that rely mostly on qualitative interviews. My colleague Konstantina Xipolitakis drafted the questionnaire, which was subsequently used in order to answer the research questions of the current study and conduct the proper statistical analysis. The replies were gathered using the internet application Google Forms, and the link to the questionnaire was delivered electronically.

Sampling is the enumeration of particular characteristics of a portion of the population, and the portion of the population that is enumerated is the sample. In general, there are two distinct sampling techniques for choosing survey respondents: probability or representative sampling and non-probability sampling. The distinction between these two approaches rests in the selection of the sample, i.e., in probability sampling, people are picked at random with equal probability, but in non-probability sampling, individuals are not selected at random (Saunders, M. et al., 2009).

The sample of the current research comprises numerous customers who were found via social networking media; hence, a probability sample was conducted in which individuals were picked randomly with equal odds of selection.

Lastly, a pilot survey was conducted prior to the distribution of the questionnaires in order to eliminate any unclear or difficult questions/suggestions, any conceptual or syntactical problems, and to decrease answer errors in general. Thus, the questionnaire was sent online to 24 academics working in different sectors of the agri-food industry and 6 executives of food and beverage corporations. The opinions were considered, and after some revisions, the final form and content of this study's questionnaire were selected.

5.5 Data collection and analysis

In total, 178 adults from different parts of Greece took part in the study. The majority of the sample, who indicated that they lived in an urban center, as well as a sizable number of participants from other semi-urban areas, voluntarily filled out an electronic questionnaire that was provided to them. The survey was filled out between December 15, 2022, and January 17, 2023.

The following chapters of the diploma study provide descriptions of the research's findings and conclusions. Using the statistical program IBM SPSS Statistics Version 22.0, the data were entered and coded correctly, reliability and validity checks were performed, the demographic

makeup of the sample was examined, and descriptive and inductive analyses of the data were performed in order to determine the results and, consequently, the research's conclusions. Finally, using the same statistical tool, the following graphs and tables were produced.

6. RESEARCH STATISTICS

This specific chapter contains a detailed presentation of the findings from the study on foods and drinks in the Greek region that include plant-based proteins following the gathering of questionnaires that had been filled out.

6.1 Reliability and validity check

The personal research questions that developed following the literature analysis and were employed in this specific diploma study led to the creation of the aforementioned questionnaire. Therefore, evaluating the questionnaire's reliability and validity is thought acceptable, two fundamental qualities.

While validity relates to whether the scale measures what it is intended to assess, reliability refers to the consistency of answers to the measuring scale. There are many different forms of reliability and validity, but in this research, the validity of the conceptual construction (construct validity) and the reliability of the internal consistency (internal consistency reliability) are examined (Cohen L. et al., 2007).

Particularly, the internal consistency reliability of an instrument's measures refers to the extent to which questions measuring the same characteristic are significantly associated with one another and with the trait itself. The internal consistency of the measurements is evaluated using Cronbach's alpha (α), a coefficient of reliability. When Cronbach's alpha coefficient obtains values more than or equal to 0.70, the dependability of the internal consistency is regarded as good, and when it receives values between 0.90 and 0.94, it is regarded as excellent. Typically, after calculating the reliability coefficient, the degree of correlation between each question and the entire sum of all questions is determined. Finally, the questions that have a poor correlation with the entire sum of all questions have a negative

impact on the dependability of the measures, and therefore it is judged important to take remedial action regarding these questions (Cronbach L., 1951; Tavakol M. et al., 2011).

In contrast, conceptual construct validity refers to the extent to which an instrument truly measures what it was designed to measure, as it can be evaluated using statistical techniques to determine if questions belonging to the same dimension represent a common element. The employed Factor Investigation techniques are based on the analysis of the structure of the correlation matrix between the questions, and often the Exploratory Factor Analysis is performed (Fabrigar L. et al., 2012).

6.1.1 Scales

In this study, the following scales were used:

1. The scale of food choices and consumption. This scale consists of eight food sub-items that indicate the overall image that people have of the influence of their decisions on their intake of these foods a year ago and what their consumption goal will be after six months in terms of conventional products and the products with alternative proteins. The questions as shown in the questionnaire are 3, 6 and 11. Meat (beef, hog, chicken, lamb, etc.), cured meats, fish, shellfish, milk, cheese, yogurt, and eggs were the items for which respondents were questioned about their consumption a year ago and their prospective consumption after 6 months. The responder was able to indicate the frequency of intake of certain foods by recording the matching number on a seven-point Likert scale. The scale was interpreted as follows: "1- I do not eat at all, 2- I eat very little, 3- I eat a little, 4- I eat the same, 5- I eat a little more, 6- I eat more, and 7- I eat much more."

Table 6.1: Cronbach α internal consistency index (food choices and consumption)

Reliability Statistics

Cronbach's Alpha	N of Items

0.846	16

2. The ratio of meat to milk. This scale consists of two questions concerning substituting plant-based meat and milk for traditional meat and milk. The question as depicted in questionnaire 4. Respondents are asked to indicate the degree to which they have contemplated substituting meat and dairy products with new plant-based goods. The scale was interpreted as follows: "1- not at all, 2- very little, 3- a little, 4- neither at all nor very much, 5- a bit too much, 6- a great deal, 7- very much."

Table 6.2: Cronbach α internal consistency index (The ratio of meat to milk)

Reliability Statistics

Cronbach's Alpha	N of Items
0.731	2

3. Influencing reasons. This scale consists of eleven sub-questions regarding the reasons that influenced or would influence (if one does not follow a sustainable plant-based diet) the decision to follow an exclusively sustainable plant-based diet. The question as depicted in the study questionnaire is 8 and the following are the grounds the responder is requested to address:
    1. Concerns over the lack of resources (e.g., increased resources required to produce animal foods compared to plant-based products)
    2. Health (e.g. enhancing physical health, managing chronic illness) (e.g. improving physical health, managing chronic disease)
    3. Loss of weight/management of weight
    4. Ethical concerns (e.g. animal rights, animal welfare, an ethical issue with the consumption of animal products)
    5. Dislike towards animal products (eg taste, texture, smell, etc.)
    6. Economic worries (e.g. cost of animal products versus plant-based products)

7. Religious motives
8. Political motives (e.g. world hunger, the disproportionate spread of wealth)
9. Personal influences (e.g. regular diet at home, a habit of a particular diet from early childhood, etc.)
10. Social impact (eg friends following a vegan diet, the increasing popularity of vegan diets on social media, etc.)
11. Increased supermarket availability of herbal goods (e.g. wide variety and ease of access)

The responder was given the opportunity to express his level of agreement with each statement by marking the matching number on the 7-point Likert scale. The scale was interpreted as follows: "1- extremely little, 2- very little, 3- little, 4- neither extremely little nor extremely much, 5- little much, 6- much, 7- extremely much."

Table 6.3: Cronbach α internal consistency index (Influencing reasons).

Reliability Statistics

Cronbach's Alpha	N of Items
0.836	11

4. Food Neophobia Scale Food Neophobia Scale (FNS) (Pliner and Hobden, 1992). Which includes the following nine propositions:
    1. I am constantly trying new and different foods
    2. I don't trust new foods
    3. If I don't know what's in a food, I won't try it
    4. I like food from different countries
    5. Ethnic cuisines and their foods seem too strange to me to eat
    6. At dinners, I try new foods
    7. I'm afraid to eat things I've never eaten before
    8. I am very particular about the food I will eat

9. I will eat almost anything

These nine statements explain their hesitation to explore new meals or their desire to do so. The responder was able to express his degree of agreement with each statement by marking the matching number on a seven-point Likert scale. 1 - Strongly disagree, 2 - Disagree, 3 - Slightly disagree, 4 - Neither agree nor disagree, 5 - Slightly agree, 6 - Agree, 7 - Strongly agree. In order to compute Cronbach's internal consistency index, reverse coding was required since questions 1, 4, 6, and 9 have a positive connotation whereas questions 2, 3, and 5 have a negative meaning.

Table 6.4: Cronbach α internal consistency index (Food Neophobia Scale)

Reliability Statistics

Cronbach's Alpha	N of Items
0.787	9

5. Plant-Based Protein Interest in Trying, Purchasing, and Paying More (Koning et. al., 2020). The particular scale consists of three (3) propositions that let us determine whether respondents are willing to test, purchase, and pay extra for foods of plant origin, as well as meat (beef, swine, chicken, lamb, etc.), cured meats, fish, milk, cheese, yogurt, eggs, enriched bakery items, and pasta. These items are shown on the questionnaire as questions 22, 23, 24, 25, 26, 27, and 28. The responder is required to reply to the following:
    1. I am willing to experiment with plant-based proteins.
    2. I am willing to purchase plant-based protein.
    3. I am prepared to pay extra for protein derived from plants.

    The responder was able to express his possibility of an agreement with each statement by marking the matching number on a seven-point Likert scale. The scale's interpretation was as follows: 1 - Strongly impossible, 2 - Impossible, 3 - Slightly impossible, 4 - Neither impossible nor possible, 5 - Slightly possible, 6 - Possible, and 7 - Strongly possible.

Table 6.5: Cronbach α internal consistency index (Plant-Based Protein Interest in Trying, Purchasing, and Paying More)

Reliability Statistics

Cronbach's Alpha	N of Items
0.911	19

6.2 Demographic composition of the sample

In order to better view and analyze the demographics of the questionnaire, a boxplot (**figure 6.1**) containing a list of all the demographics at the bottom and the sub-questions of the demographic questions as they occur in the questionnaire was built. Grouped at the top and rearranged according to the numbers from 1 to 7 to improve the graph's display and explanation. Thus, in terms of age, the median seems to be in the first age group of 18-29, where more than half of the population falls, although 84.8% of the population falls in the first three age groups between 18 and 49 years. The same can be seen from the first and third percentiles in **table 6.6**. Regarding the location of residence, the majority live in an urban center (61.8%) since which is also observed from the median in the same table, although many also dwell in a semi-urban center (24.7% of the total). In addition, it is important to note that the majority of respondents to the study's questionnaire are college graduates and/or postgraduate degrees, with college graduates constituting 45.5% of the total. Simultaneously, 75.8% of the population is employed, which is obvious from the figure as the median is at number one, i.e., in the first category of the professional status of employees to be analyzed. Regarding yearly income, the majority fall into the second and third groups, i.e., those with an annual income between €6,000 and €12,000 and between €12,000 and €24,000. Collectively, they account for 65.2% of the population, while the typical yearly income is between €12,000 and €24,000.

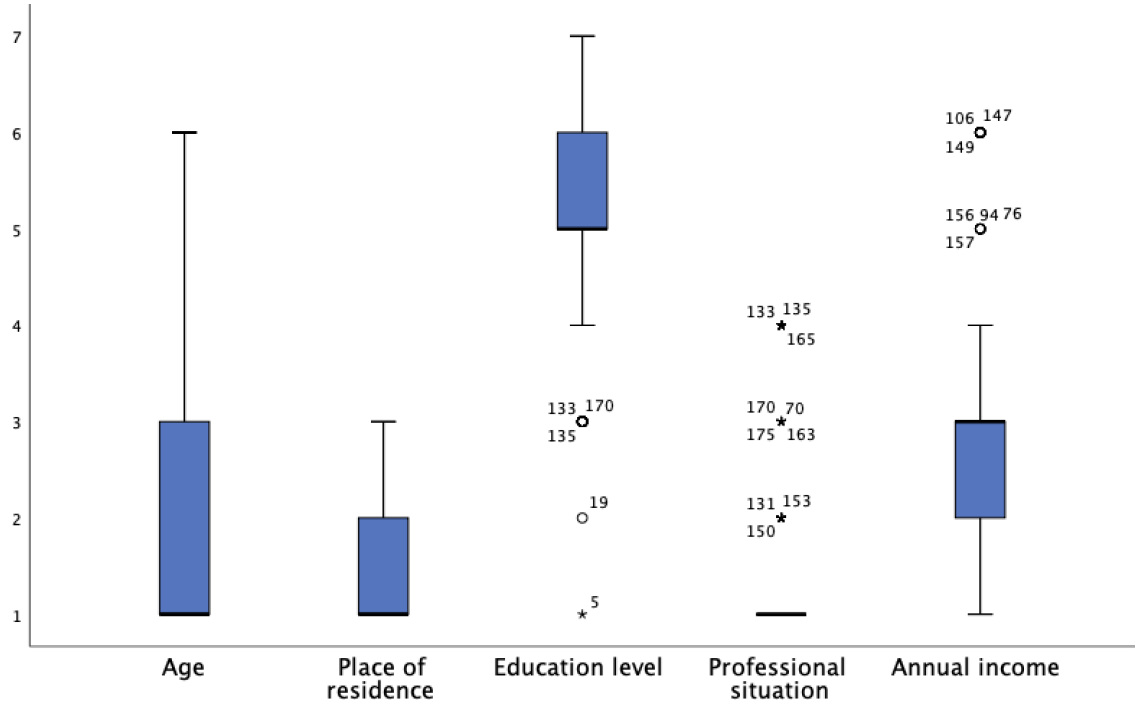

Figure 6.1: Demographic data are shown in the Boxplot.

Table 6.6: Descriptive statistics of demographics in tables

		Age	Place of residence	Education level	Professional situation	Annual income
N	Valid	178	178	178	178	178
	Missing	2	2	2	2	2
Median		1.00	1.00	5.00	1.00	3.00
Std. Deviation		1.249	.723	1.041	1.053	1.345
Percentiles	25	1.00	1.00	5.00	1.00	2.00
	50	1.00	1.00	5.00	1.00	3.00
	75	3.00	2.00	6.00	1.00	3.00

6.3 Descriptive data analysis

First, a descriptive analysis of the data was performed taking advantage of the SPSS Statistics program and using questions/suggestions from the questionnaire regarding consumer consumption patterns and the length of time that each pattern is followed, justifications for not adopting a plant-based diet, and the preferred modern or traditional

plant proteins. On questions on customers' neophobia and readiness to buy and/or try a plant-based product, a descriptive analysis of the data was also done. These questions were answered by 178 individuals.

Regarding the consumption habits of consumers, it appears (**figure 6.2**) that the largest proportion of Greeks frequently consumes all animal sources of protein-meat, such as beef, pork, chicken, turkey, fish and/or shellfish (Omnivore) and corresponds to 65.4% of the total population, followed by the group that consumes meat occasionally, but tries to reduce its consumption and frequently opts for proteins of vegetable origin (Flexitarian) with a percentage that reaches 26.1%. This is followed by the Pescetarian group, which eats only fish and/or shellfish, but no other forms of meat (3.2%), and the Vegetarian group, which consumes only eggs and/or dairy products, but no other types of meat or fish (2.8%). Lastly, 2.1% of the population does not consume animal protein sources, including meat, fish, eggs, dairy products, and other animal elements (Vegan), while 0.5% adhere to a different diet.

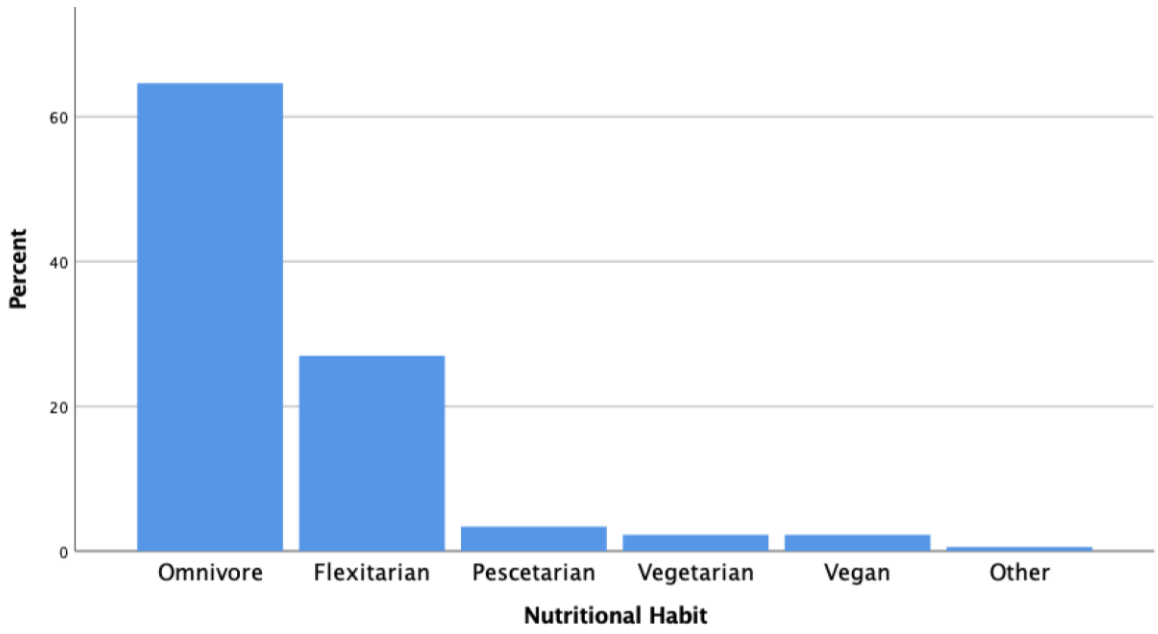

Figure 6.2: Simple Bar Percentage of the Nutritional Habits of Greek Consumers

The majority do not intend to replace meat (beef, lamb, chicken, swine, etc.) with conventional alternative proteins (e.g., legumes, mushrooms, etc.) or dairy products (milk, cheese, feta, yogurt, etc.) with the new alternatives on the market (plant-based dairy products). As a proportion of the whole population, however, a steady and modest tendency

to substitute meat with conventional alternative proteins is noted. In contrast, there is a minor rise in the substitution of dairy products with plant-based milk products among the population as a whole. Comparing the aforementioned forms of food in both figures (**figure 6.3, figure 6.4**) shows that the readiness to replace percentages for meat and milk is about equivalent.

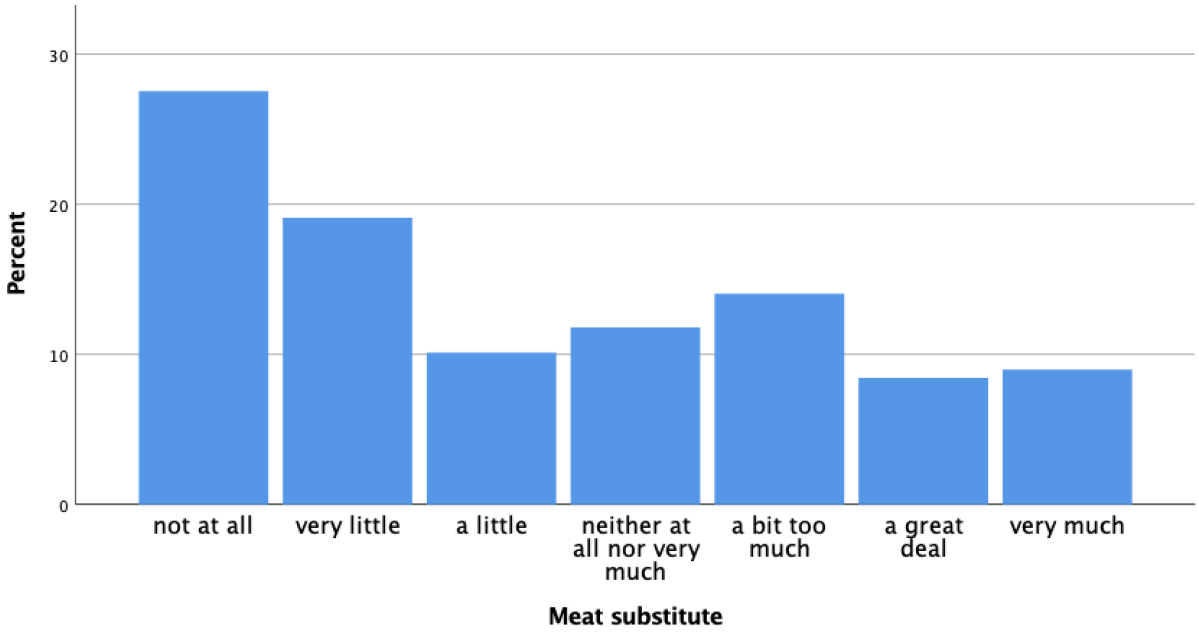

Figure 6.3: Simple Bar Percent of meat substitutes (beef, lamb, chicken, pork, etc.) with traditional alternative proteins (e.g. legumes, mushrooms, etc.)

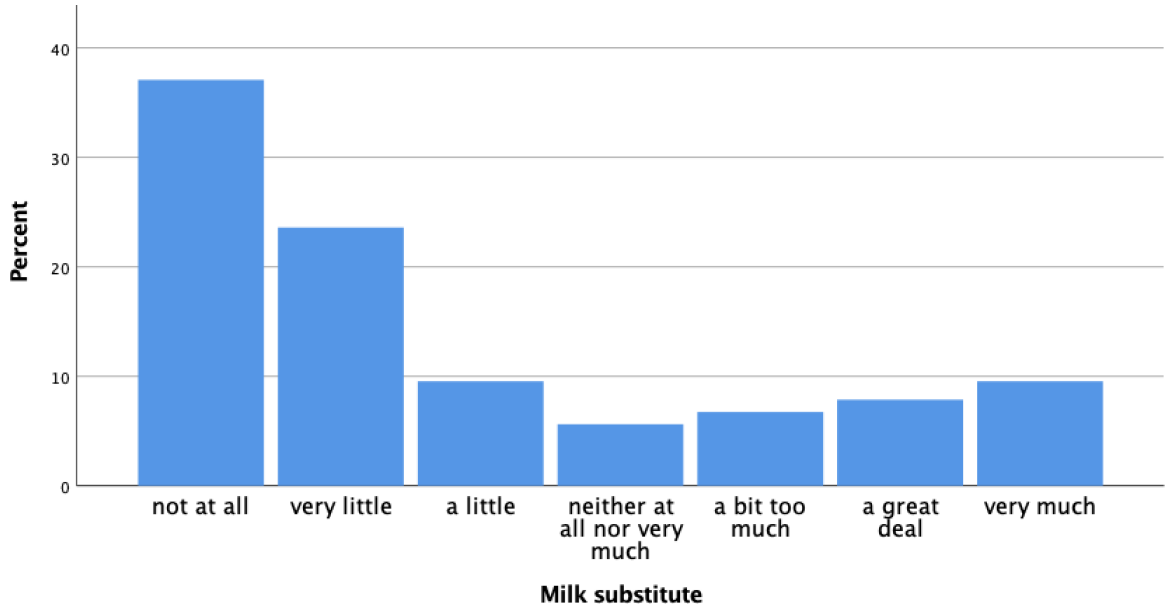

Figure 6.4: Simple Bar Percent of milk substitutes (milk, cheese, feta, yogurt, etc.) with the new substitutes on the market (plant-based dairy products).

As it's obvious in **Figure 6.5**, 67.6% of the population prefers plant-based protein sources based on the Mediterranean Diet (e.g. vegetables, legumes, fruits, cereals) prepared traditionally, while 29.3% prefer or would prefer a combination of sources of plant proteins based on the Mediterranean Diet and the consumption of modern/novel sources of plant proteins as well (e.g. imitation meat, dairy products, pastries and/or pasta based on legumes, etc.). The 3.2% includes those who prefer or would prefer to choose modern/novel sources of plant protein only (e.g. imitation meat, dairy products, legume-based pastries and/or pasta, etc.).

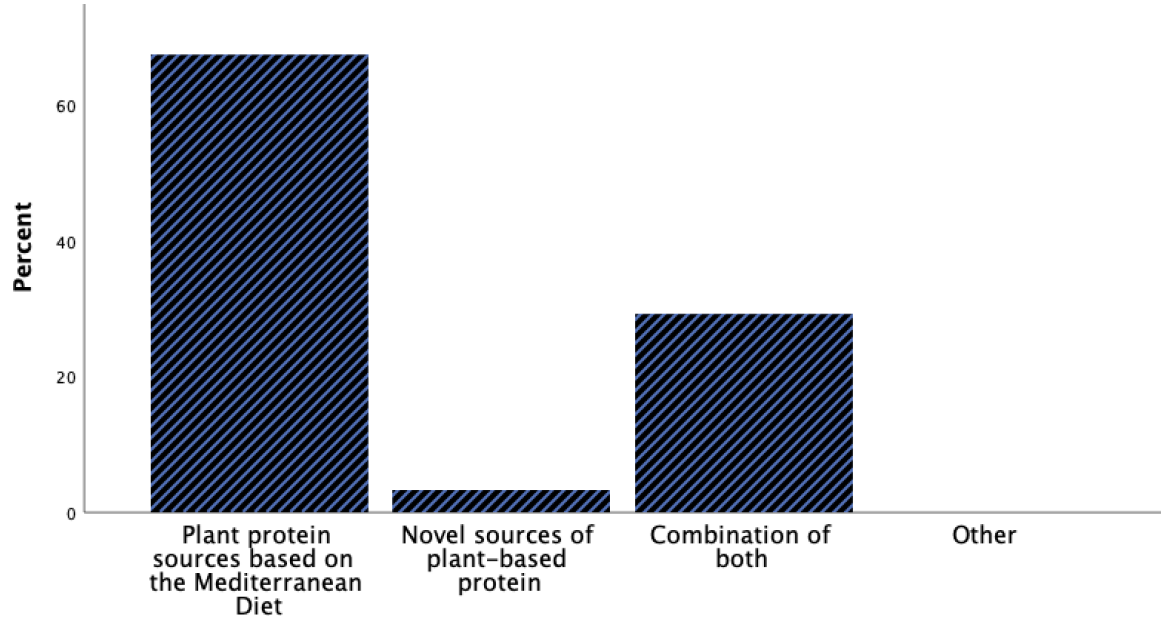

Figure 6.5: Simple bar percent of preference for novel and traditional plant protein sources

Consequently, useful information on the consumer approval of goods with plant protein sources arises from the aforementioned. It seems that a majority of people prefer the conventional Mediterranean diet rather than an alternate diet. About 30% of the population would replace meat with plant-based meat, which is almost the entire proportion that also consumes plant-based proteins (Flexitarians, Pescetarians, Vegetarians, and Vegans).

Next, the descriptive analysis was done on the data from questions/suggestions about the justifications for not adopting a plant-based diet, and the preferred modern or traditional plant proteins. Notable is the fact that in response to the question "What do you believe stops

you from adopting a plant-based protein diet?" 87.1% said that they do not want others to see them as tough or choosy (**table 6.5**). Followed by 75.8% of the population with the statement that "no one else decides on most of the food I eat," and then 74.7% of the population with the statement that "the plant-based foods I wish to eat are accessible where I buy." 74.2 percent of the public feels that plant-based foods have adequate nutrients, whereas 73.6 percent believe that plant-based meals are too prevalent. In addition, 70.2% feel that plant-based foods are readily available, and 68% can produce plant-based protein-based meals. Regardless of their eating habits, the majority of the public responds positively to the question on the intake and consumption of plant-based meals.

Table 6.7: Percentage of comments mentioning a plant-based protein diet

	Yes		No		I don't know	
	Count	Row N %	Count	Row N %	Count	Row N %
I don't want to change my eating habits	95	53.4%	73	41.0%	10	5.6%
they are not filling enough	40	22.5%	109	61.2%	29	16.3%
I am difficult or too picky	15	8.4%	155	87.1%	8	4.5%
human was born to eat meat	66	37.1%	86	48.3%	26	14.6%
I don't get enough energy or strength	59	33.1%	99	55.6%	20	11.2%
they are not tasty enough	56	31.5%	106	59.6%	16	9.0%
I should eat a lot of plant foods	68	38.2%	86	48.3%	24	13.5%
they look very unusual	36	20.2%	131	73.6%	11	6.2%
There is not enough variety	81	45.5%	77	43.3%	20	11.2%
I don't know what alternative food options I have	60	33.7%	108	60.7%	10	5.6%
They are difficult to find	34	19.1%	125	70.2%	19	10.7%
My family/partner does not eat plant-based foods	65	36.5%	111	62.4%	2	1.1%
It takes a lot of time to prepare	44	24.7%	104	58.4%	30	16.9%
Someone else decides	40	22.5%	135	75.8%	3	1.7%
They don't exist where I shop	28	15.7%	133	74.7%	17	9.6%
I don't know how to prepare plant based meals.	46	25.8%	121	68.0%	11	6.2%
Not enough nutrients	24	13.5%	132	74.2%	22	12.4%
Not enough protein	49	27.5%	103	57.9%	26	14.6%
I would worry about my health	72	40.4%	93	52.2%	13	7.3%

Additionally, 80.3% of the population responded "not at all" when asked if religion impacted or would influence (if one does not follow a sustainable plant-based diet) their choice to adopt an entirely sustainable plant-based diet (**Table 6.6**). At the same time, it seems that over half of the population and above are unaffected by both social and political effects since 133 individuals responded below the neutral level regarding social influences and 129 regarding political influences. Then, 30.9% of the population said that they are not or would not be impacted "at all" by familial influences, while just 56 individuals indicated they would be influenced "very little" or "a little." Notably, health and weight loss/weight

management were the primary factors that influenced or would influence someone to follow an exclusively sustainable plant-based diet, with 102 people responding that they were influenced "a bit much" or "a great deal" or "very too much" by health, and 80 people responding the same. As 34.8% of the population replied favorably, we may conclude that some are affected or would be influenced by ethical problems (e.g. animal rights, good treatment of animals, ethical issues with the eating of animal products).

Table 6.8: Representation of comments describing the factors that impacted or might persuade someone to pursue an entirely plant-based diet.

	not at all		very little		a little		neither at all nor very much		a bit too much		a great deal		very much	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Concerns about resource scarcity	37	20.8%	27	15.2%	28	15.7%	33	18.5%	22	12.4%	21	11.8%	10	5.6%
Health (eg improving physical health, managing disease years)	15	8.4%	13	7.3%	16	9.0%	32	18.0%	26	14.6%	35	19.7%	41	23.0%
Weight loss / weight management	29	16.3%	14	7.9%	17	9.6%	38	21.3%	32	18.0%	32	18.0%	16	9.0%
Ethical issues	39	21.9%	27	15.2%	20	11.2%	30	16.9%	19	10.7%	18	10.1%	25	14.0%
Aversion to animal products	84	47.2%	33	18.5%	25	14.0%	14	7.9%	9	5.1%	11	6.2%	2	1.1%
Financial concerns	40	22.5%	35	19.7%	25	14.0%	38	21.3%	17	9.6%	11	6.2%	12	6.7%
Religious reasons	143	80.3%	19	10.7%	4	2.2%	6	3.4%	4	2.2%	2	1.1%	0	0.0%
Political reasons	83	46.6%	25	14.0%	21	11.8%	16	9.0%	13	7.3%	10	5.6%	10	5.6%
Family influences	55	30.9%	31	17.4%	25	14.0%	25	14.0%	20	11.2%	11	6.2%	11	6.2%
Social influence	85	47.8%	31	17.4%	17	9.6%	20	11.2%	13	7.3%	7	3.9%	5	2.8%
Increased purchase of herbal products in supermarkets	46	25.8%	29	16.3%	21	11.8%	31	17.4%	24	13.5%	15	8.4%	12	6.7%

Regarding food neophobia and trying new foods, 72.6% "strongly disagree", "disagree" or "slightly disagree" with the statement "Ethnic cuisines and their foods seem too strange to me to eat them," while 71.9% respond negatively to the statement "I'm afraid to eat things I have never eaten." In fact, more than half of the population (60.1%) indicates they are not picky about the meals they consume, and 75.1% indicate they are open to trying new cuisines. Lastly, a sizeable proportion of respondents indicate that they like meals from other nations, while also trying new dishes at supper. The bulk of the population is consequently more acquainted with and eager to try new foods from a wide range of foods, as well as ones they do not know or have not tasted.

Table 6.9: Percentage of comments addressing neophobia-related statements.

	Strongly disagree Row N %	Disagree Row N %	Slightly disagree Row N %	Neither agree nor disagree Row N %	Slightly agree Row N %	Agree Row N %	Strongly agree Row N %
I am constantly trying new and different foods	7.3%	9.6%	14.0%	18.0%	13.5%	14.0%	23.6%
I don't trust new foods	33.1%	26.4%	14.6%	11.8%	7.3%	2.8%	3.9%
If I don't know what's in a food, I won't try it	12.4%	17.4%	14.6%	13.5%	12.4%	15.2%	14.6%
I like food from different countries	5.1%	3.4%	9.0%	15.2%	12.9%	20.2%	34.3%
Ethnic cuisines look very strange	36.0%	24.2%	12.4%	11.2%	6.7%	5.1%	4.5%
At dinners, I try new foods	5.6%	6.7%	8.4%	14.6%	16.9%	19.1%	28.7%
I'm afraid to eat things I've never eaten before	34.3%	27.5%	10.1%	10.1%	6.7%	8.4%	2.8%
I am very particular about the food I will eat	33.7%	16.3%	10.1%	17.4%	7.3%	6.2%	9.0%
I will eat almost anything	11.2%	12.4%	6.7%	18.5%	14.6%	15.2%	21.3%

In addition, descriptive statistics were used to examine customer preferences on the primary elements they want in processed meals including plant-based products such as plant proteins. In comparison to the other items, lentils, almonds, chickpeas, mushrooms, and oats were the ones that customers favored by a significant margin (**Figure 6.6)**. 73.5 percent of the population (N=178) favored mushrooms as the primary component in processed meals, followed by oats (70.9 percent) and lentils (70.9 percent). Notably, 66.1% of the whole population favored chickpeas. A bit more than half of the public (53.4% to be exact) selected peas as the primary component in processed goods, while 46.6% of consumers preferred beans and hazelnuts. They are followed by quinoa (40.7%), cashews (40.2%), sunflower seeds (33.9%), and fava beans (33.8%). The ingredients with the lowest preference ratings were coconut (31.7%), pumpkin seeds (29.1%), soy (28.6%), spirulina (24.9%), and hemp seeds (24.3%). Only 4.2% of the population does not choose any of the aforementioned as the primary component in processed meals containing vegetable elements such as plant-based protein. The Greek consumer prefers mushrooms, lentils, oats, almonds, and chickpeas as primary components in processed foods.

To examine the perspectives of Greek customers on plant-based meals and whether they would purchase alternative foods to sample or incorporate into their diet, descriptive data on the availability of meat and dairy alternatives in grocery stores were compiled. In order to analyze the accessibility of these items using a boxplot (**Figure 6.7)**, they were categorized as

follows: "1 = easy access," "2 = not at all accessible," and "3 = perhaps easy access." It seems that the median for meat replacements is 2 (**Figure 6.7, Table 6.10)**, with 33.3% of the population indicating that it is difficult to get dietary alternatives. On the other hand, it is seen that the range is vast and evenly distributed, indicating that almost the same amount of respondents said that accessing food replacements is easy (30.7%) or maybe easy (36%). Regarding dairy product alternatives, however, the median is at 1, indicating that the public thinks it easy to get dairy product substitutes, and the range of responses is almost confined, as 77.2% of respondents respond favorably.

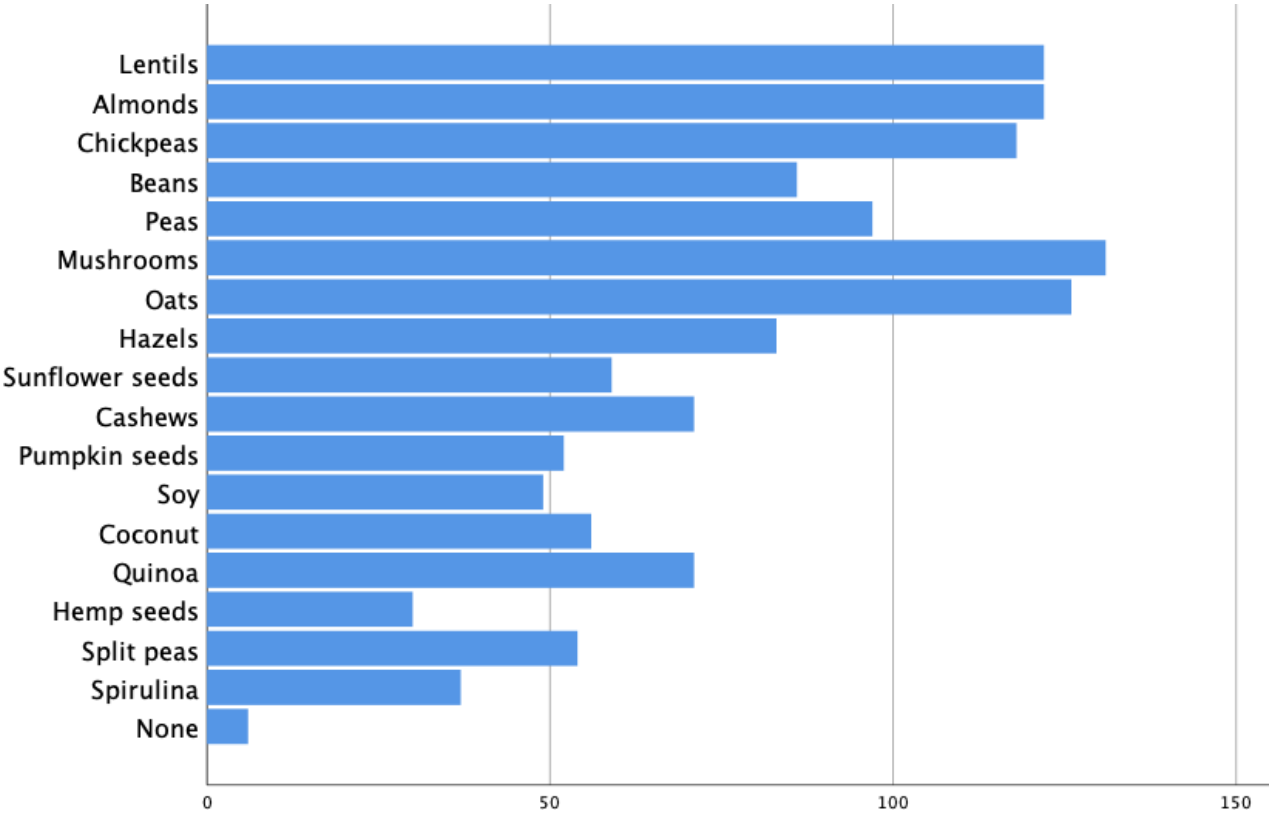

Figure 6.6: The consumers' desire for plant-based components such as plant-based protein as the primary constituents in processed meals.

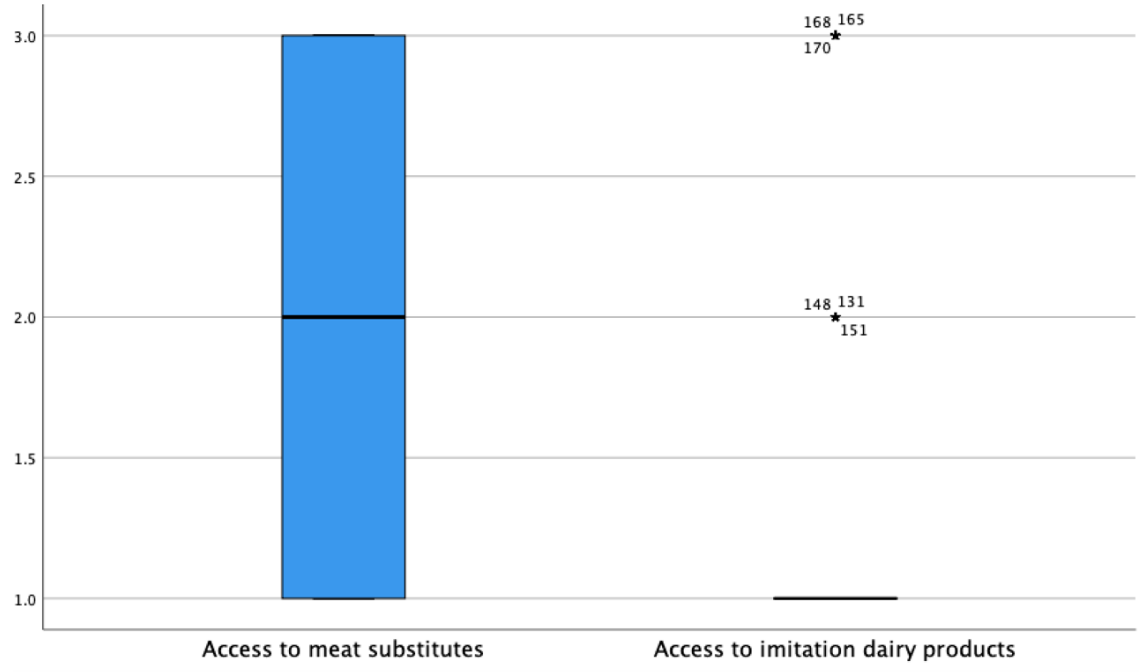

Figure 6.7: Boxplot depiction of customer perceptions on the availability of meat and dairy replacements in grocery stores.

Table 6.10: Descriptive statistics on the availability of meat and dairy substitutes in food stores.

		Access to meat substitutes	Access to imitation dairy products
N	Valid	178	177
	Missing	2	3
Median		2.00	1.00
Std. Deviation		.823	.728
Percentiles	25	1.00	1.00
	50	2.00	1.00
	75	3.00	1.00

More precisely, plant-based burgers seem to be the most common meat replacement in grocery shops, accounting for 72.5% of the population and 137 consumers (**Figure 6.8**). This is followed by plant-based ground meat (40.7% of the total), plant-based meatballs (33.3% of the total), and schnitzel/chicken (27.5% of the total). In addition, plant-based sausages are

selected by 43 people (22.8%), gyros by 35 (18.5%), and cold meats by 33 (17.7%). Finally, 13.2%, 4.8%, and 1.6% of the total selected plant-based kebabs, eggs, and fish, respectively. Only 27 consumers (14.3%) were unaware of the availability of the aforementioned beef alternatives.

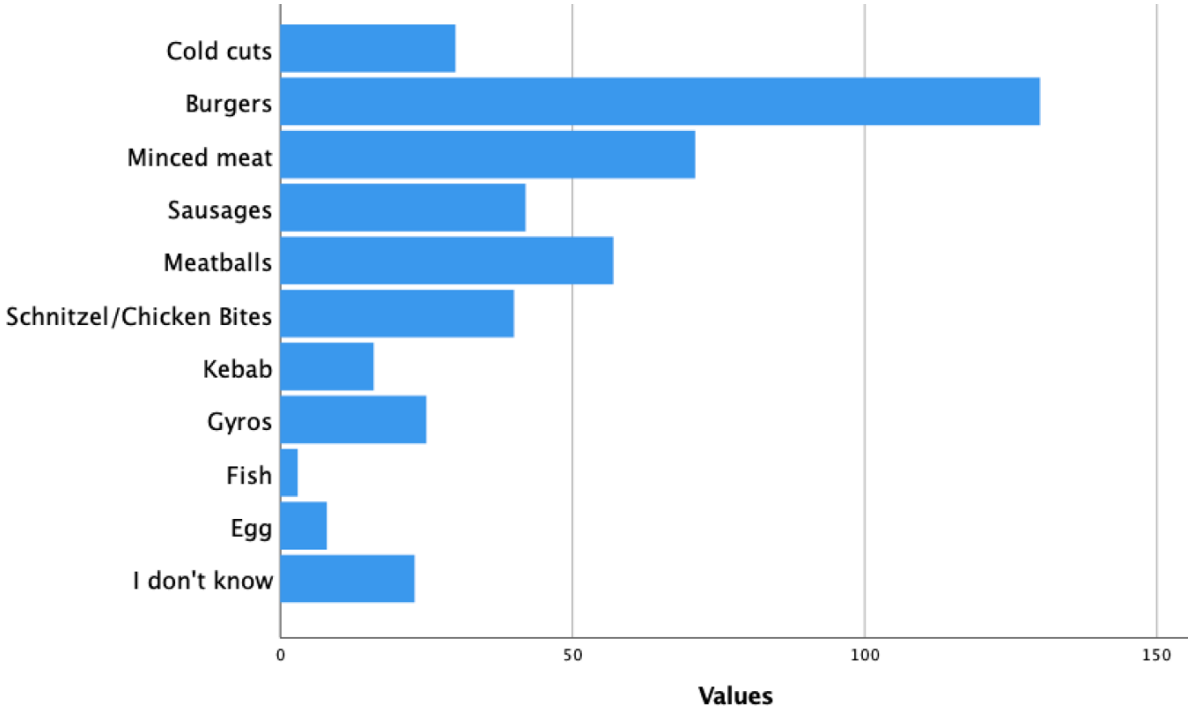

Figure 6.8: Illustration of the plant-based meats most commonly found in food stores

Similarly, plant-based milk seems to be the most often encountered dairy substitute, as 160 of the total population (N=178) selected milk as the most common dairy alternative found in food stores (**Figure 6.9)**. It is followed by cheese (76 people) and yogurt (69 people) relative to the whole population. Finally, most individuals (151) do not seem to be able to find ice cream at grocery shops.

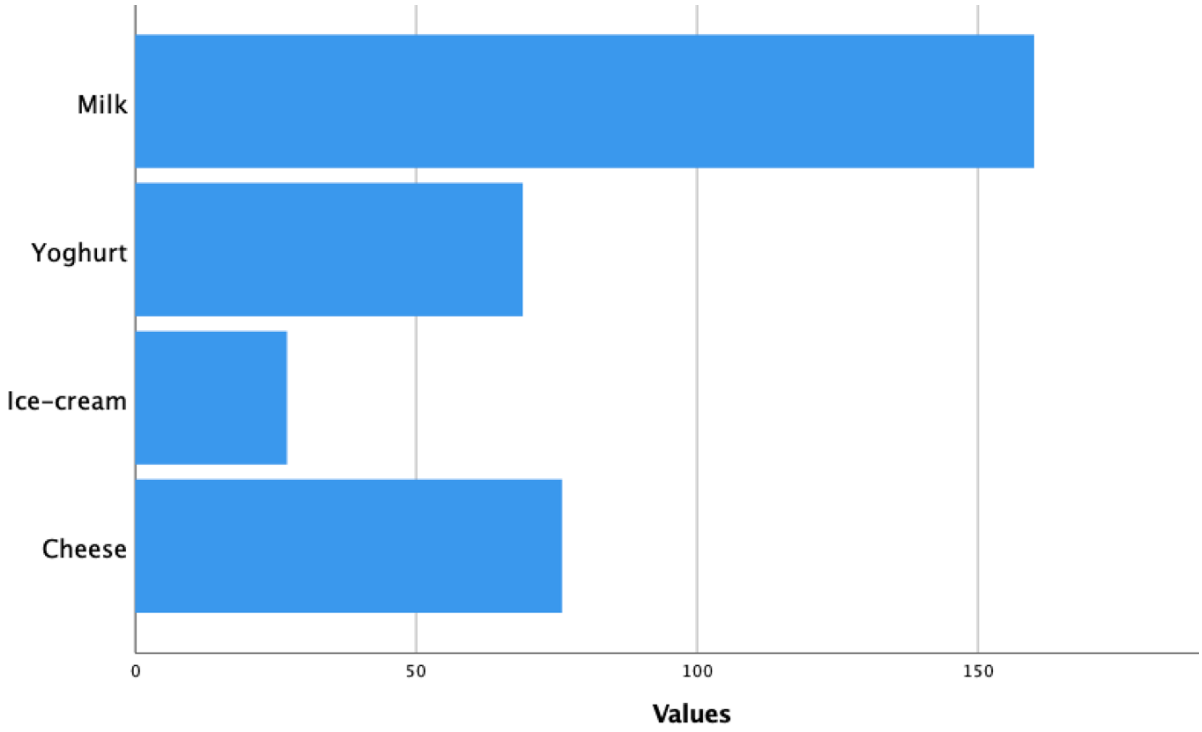

Figure 6.9: Illustration of the plant-based dairy products most commonly found in food stores

Pasta and baked goods that were fortified with plant-based proteins (e.g., legume/pea flour) were other groups that were researched and worthy of a statistical description. In light of this, customers were surveyed on the accessibility of pasta and pastries containing plant-based protein. In order to study the data in boxplot format, the opinions of the respondents were coded as follows: 1, easy access to pasta and baked goods enriched with plant-based protein; 2, not easy access to pasta and baked goods enriched with plant-based protein; 3, maybe easy access to pasta and baked goods enriched with plant-based protein. It was observed, as indicated by the means in both the boxplot (**Figure 6.10)** and the table (**Table 6.11**), that the mean tends toward the number 2, i.e., it is not easy to access pasta and pastries enriched with plant-based protein, while the ranges of the columns in the image are large, indicating that roughly the same percentage of the population for both types of food answered that it is easy to access, that it is not easy to access as well as that perhaps it is easy to access pasta and pastries enriched with plant-based protein.

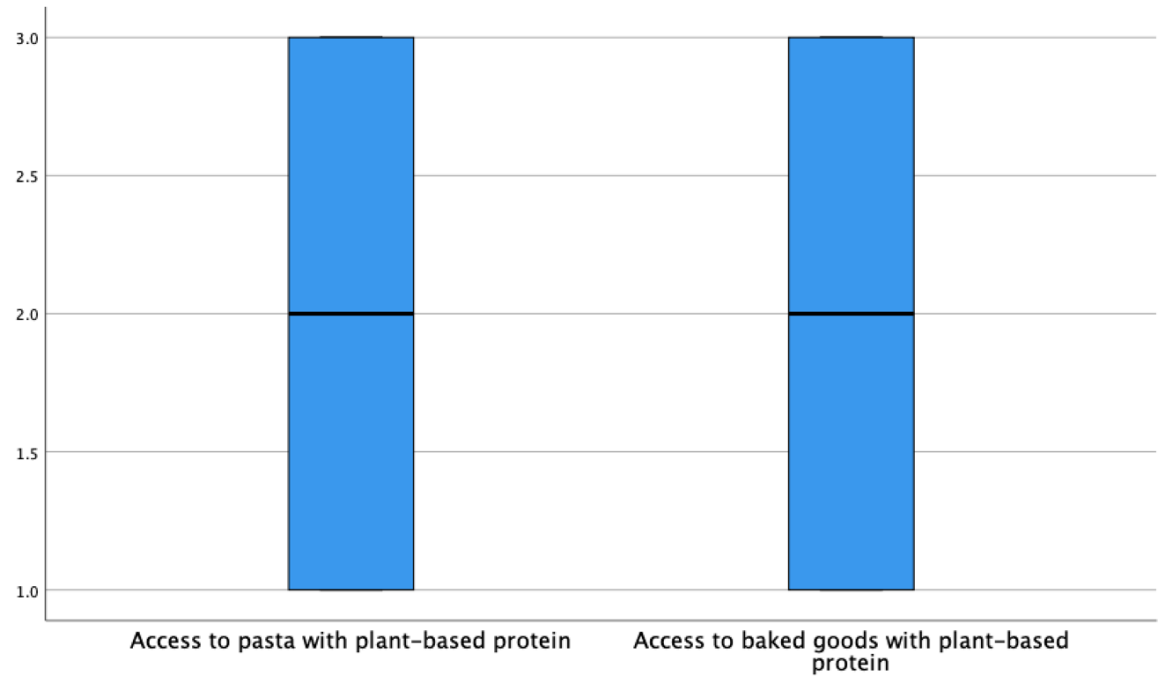

Figure 6.10: Boxplot depiction of customer perceptions on access to pasta and baked goods with plant-based protein

Table 6.11: Descriptive statistics on the availability of pasta and baked goods with plant-based protein

		Access to pasta with plant-based protein	Access to baked goods with plant-based protein
N	Valid	178	176
	Missing	2	4
Median		2.00	2.00
Std. Deviation		.873	.810
Percentiles	25	1.00	1.00
	50	2.00	2.00
	75	3.00	3.00

Due to the fact that food substitutes have the same flavor and texture as the corresponding conventional foods, it was deemed important to study the possibilities so that consumers can include them in their diet, pay a higher price, and purchase meat, cold cuts, fish, milk, cheese, yogurt, eggs, as well as pasta and pastries enriched with plant-based

proteins. Regarding meat (beef, pork, chicken, lamb, etc.), cold meats, fish, milk, cheese, yogurt, and eggs, 48.9% of the population stated that it is extremely impossible that they would include plant-based eggs in their diet instead of conventional egg, while 47.8% stated that it is extremely impossible that they would include plant-based fish in their diet even if it had the same taste and texture as conventional fish (**Table 6.12**). Additionally, 50.6% of the total answered that it is either strongly impossible, impossible or slightly impossible that they would incorporate meat of plant origin in their diet compared to traditional meat, while 55.6% expressed the same for cold meats. However, it revealed that consumers are more acquainted with plant-based milk, as 26.4% answered that it is strongly possible to replace it with traditional milk, 11.8% claimed that it is possible to replace it, and 13.5% stated that it is slightly possible to replace it. Regarding cheese, 44.4% of respondents said that it is strongly impossible, impossible, or slightly impossible that they would incorporate cheese of vegetable origin into their diet, while 19.1% indicated that it is neither impossible nor possible. **Figure 6.11** is a stack graph displaying the percentages of the people according to their opinions on the aforementioned meals.

Table 6.12: The percentages of the population who are likely to include the following plant-based foods in their diet rather than conventional foods.

	Strongly impossible Row N %	Impossible Row N %	Slightly impossible Row N %	Neither impossible nor possible Row N %	Slightly possible Row N %	Possible Row N %	Strongly possible Row N %
Meat	24.7%	16.9%	9.0%	24.2%	12.4%	6.2%	6.7%
Cold cuts	29.2%	14.0%	12.4%	22.5%	8.4%	3.4%	10.1%
Fish	47.8%	15.7%	9.6%	17.4%	3.9%	4.5%	1.1%
Milk	9.6%	7.3%	11.8%	19.7%	13.5%	11.8%	26.4%
Cheese	19.1%	16.3%	9.0%	19.1%	18.0%	8.4%	10.1%
Yoghurt	24.2%	16.3%	10.7%	19.1%	10.1%	11.8%	7.9%
Egg	48.9%	17.4%	6.2%	17.4%	3.9%	1.7%	4.5%

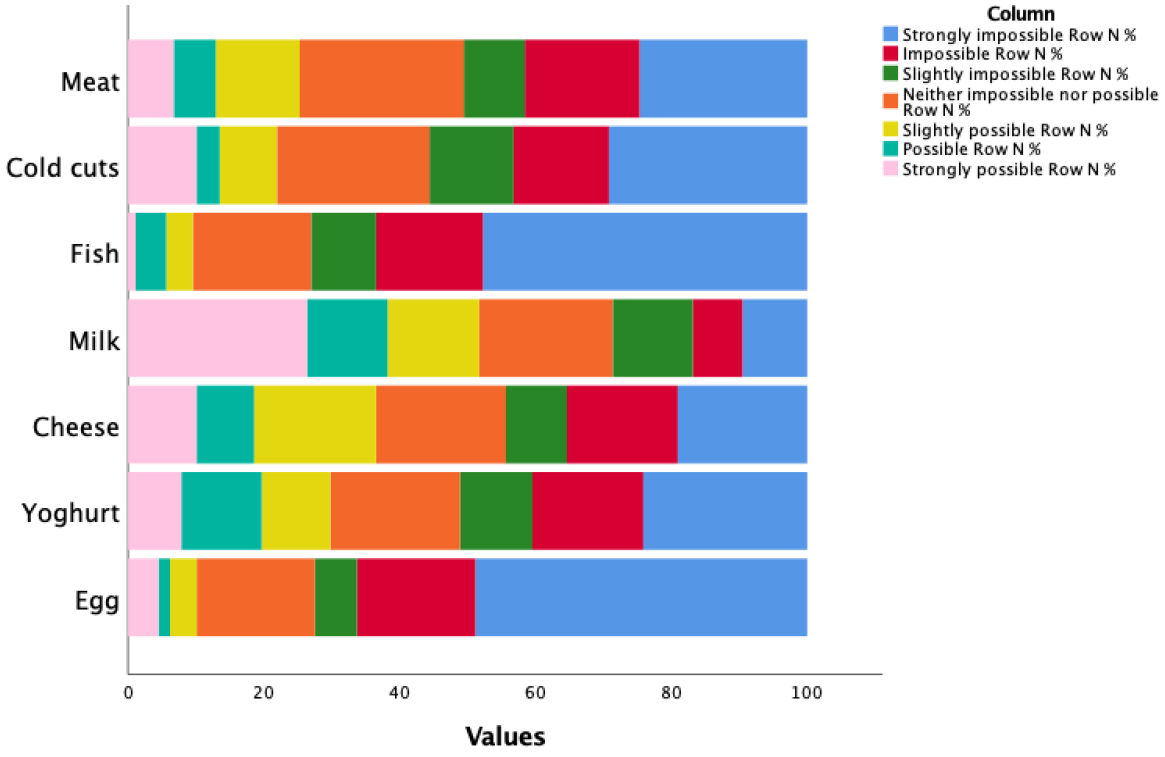

Figure 6.11: Stack graph illustrating the percentages of individuals who are more likely to consume the following plant-based diets than conventional foods.

The same descriptive analysis was run on the same items to determine the likelihood that customers would pay a higher price for meat (beef, hog, chicken, lamb, etc.), cold cuts, fish, milk, cheese, yogurt, and plant-based eggs origin compared to these traditional goods. Thus, 55.1% of respondents answered that it is strongly impossible to pay for eggs of plant origin and 53.9% stated that it is strongly impossible to pay for fish of plant origin, but 11.8% and 12.8% stated that there is a potential that they would pay a higher price to purchase them respectively. 58.4% of the public said that it is strongly impossible or impossible that they would pay a higher price for plant-based cured meats, while 54% expressed the same for plant-based meat. Regarding cheese and yogurt, 59.5% of respondents said that it is either strongly impossible, impossible, or slightly impossible that they would pay more for cheese, and 61.7% of respondents indicated that they would not pay more for plant-based yogurt. In contrast, it is interesting that customers reacted favorably to the notion of purchasing plant-based milk at a higher price. 19.1% of respondents said that it is strongly possible to purchase the product, while 7.9% and 12.9% indicated that it is possible and slightly possible to purchase the product, respectively. By comparing tables 6.12 and 6.13 as well as figures 6.11

and 6.12, it is possible to conclude that the preference for specific plant-based foods is proportional to their price and cost and that the likelihood that consumers will include the aforementioned plant-based foods in their diet relative to conventional foods decreases as the price increases.

Table 6.13: The percentages of the population who are likely to pay more for the following plant-based foods in their diet rather than conventional foods.

	Strongly impossible Row N %	Impossible Row N %	Slightly impossible Row N %	Neither impossible nor possible Row N %	Slightly possible Row N %	Possible Row N %	Strongly possible Row N %
Meat	36.0%	18.0%	7.3%	18.0%	9.6%	3.9%	7.3%
Cold cuts	39.9%	18.5%	6.7%	15.2%	10.7%	3.4%	5.6%
Fish	53.9%	12.4%	5.6%	15.2%	6.7%	2.2%	3.9%
Milk	24.7%	9.6%	6.7%	19.1%	12.9%	7.9%	19.1%
Cheese	36.5%	16.3%	6.7%	14.0%	12.4%	5.6%	8.4%
Yoghurt	34.8%	15.7%	11.2%	14.0%	11.2%	6.2%	6.7%
Egg	55.1%	15.7%	3.4%	14.0%	4.5%	3.4%	3.9%

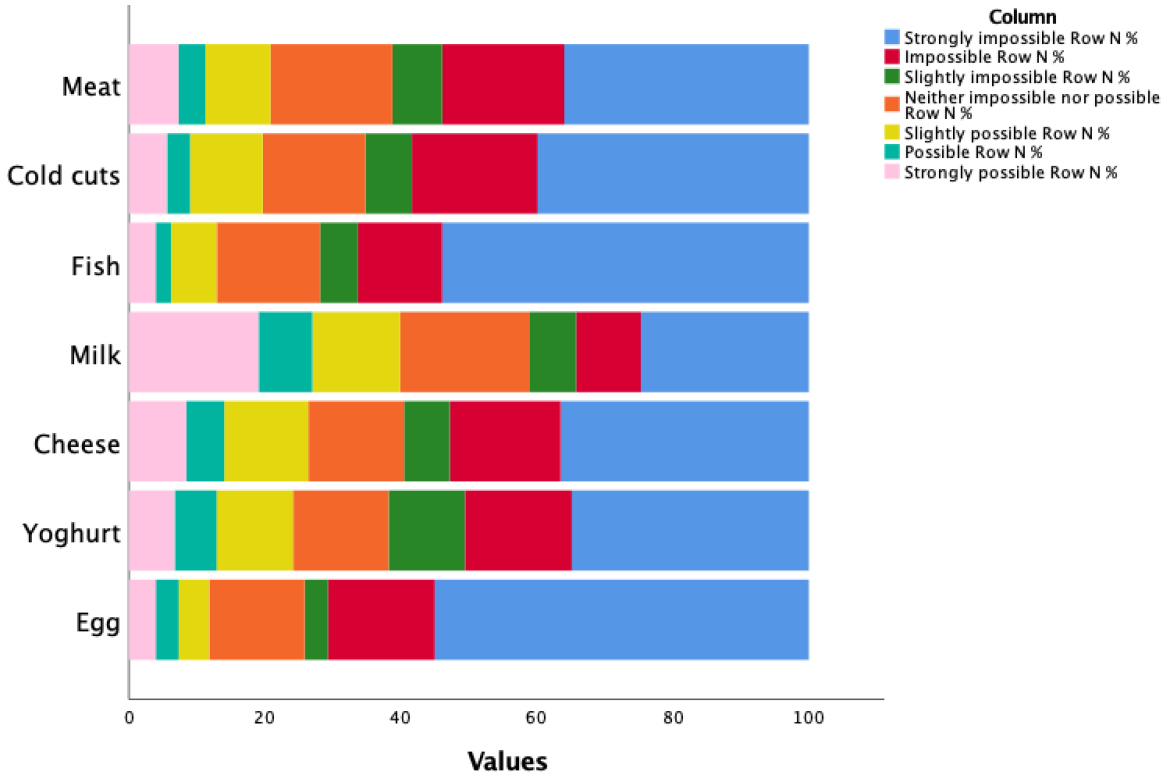

Figure 6.12: Stack graph illustrating the percentages of individuals who are more likely to pay more for the following plant-based diets than conventional foods.

Regarding the likelihood that consumers will include bakery and pasta substitutes in their diet instead of conventional bakery and pasta products, the median was found to be number 5 (**Figure 6.13**), which corresponds to the fact that the consumer is almost certain to include enriched bakery products and pasta with plant-based protein in their diet and is found with the largest proportion of the population (22%). The average population falls between the probabilities "neither impossible nor possible," "slightly possible," and "possible" (where they correspond to the numbers 4, 5, and 6 as categorized in order to perform the statistical analysis in SPSS), inferring that the majority of respondents were in favor of including these types of foods because baked goods (e.g., bread or cookies without eggs or butter) and pasta taste and feel identical to conventional goods.

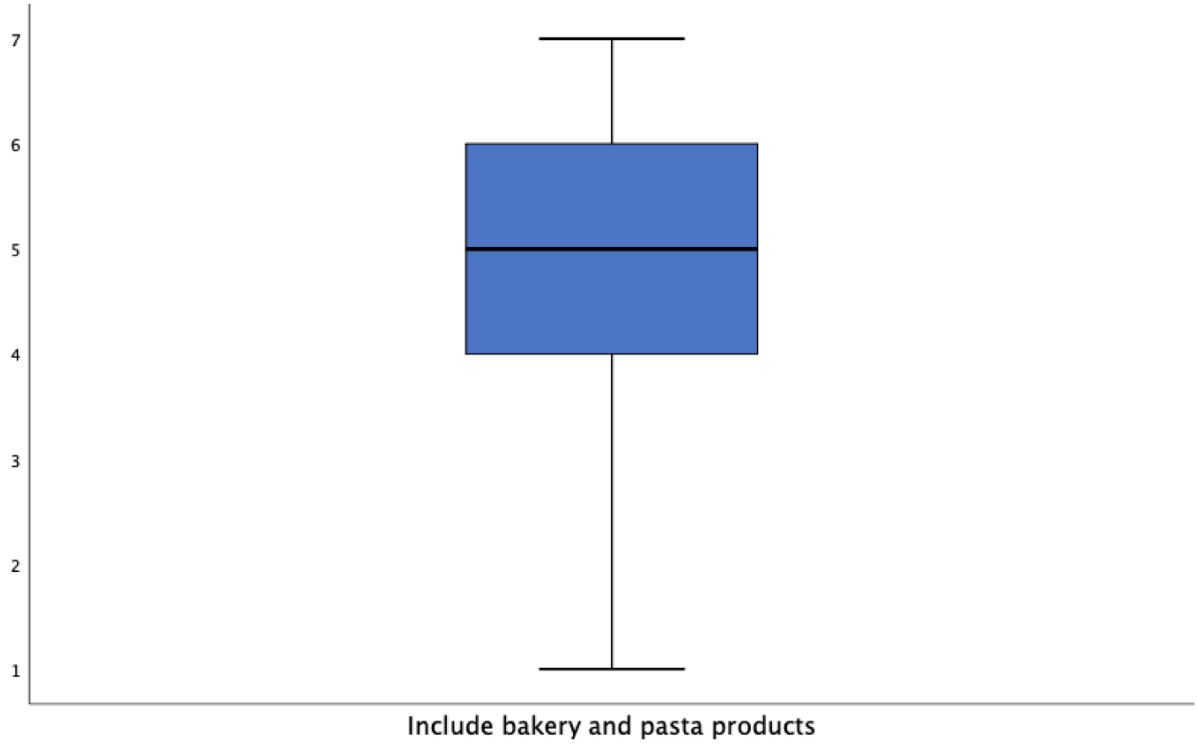

Figure 6.13: The likelihood that customers will incorporate enriched pasta and bakery goods with plant-based protein in their diet is shown in the form of a boxplot.

Table 6.14: Descriptive statistics of customers' likelihood of incorporating plant-based protein-enriched pasta and bakery products into their diet.

Statistics

Include bakery and pasta products

N	Valid	178
	Missing	2
Median		5.00
Std. Deviation		1.775
Percentiles	25	4.00
	50	5.00
	75	6.00

In addition, descriptive statistics were used to examine the chance that customers would pay a greater price for enhanced bread and pasta items than for regular ones. In particular, 20.8% of the population as shown in **Table 6.15** said that it is slightly possible to pay a greater premium for enhanced bakery items than for normal baked goods. Based on Boxplot (**Figure 6.14),** the median seems to be at 4 (as classified in Chapter 6.1.1 of this diploma in order to do the statistical test), indicating that it is neither impossible nor possible that customers would pay a higher price for enriched bread items. On the other hand, it is evident from examining the boxplot about enriched pasta that the median value is 5, indicating that customers are inclined to spend a greater price for enhanced pasta items than for normal pasta. In both items shown in the same picture, the range is the same, with a little propensity to buy these enhanced goods.

Table 6.15: The proportion of the population who are more inclined to pay a premium for upgraded bread and pasta products than for regular meals.

	Strongly impossible Row N %	Impossible Row N %	Slightly impossible Row N %	Neither impossible nor possible Row N %	Slightly possible Row N %	Possible Row N %	Strongly possible Row N %
Bakery products	11.2%	8.4%	12.9%	18.5%	20.8%	15.7%	12.4%
Pasta products	11.2%	8.4%	12.9%	13.5%	23.6%	16.9%	13.5%

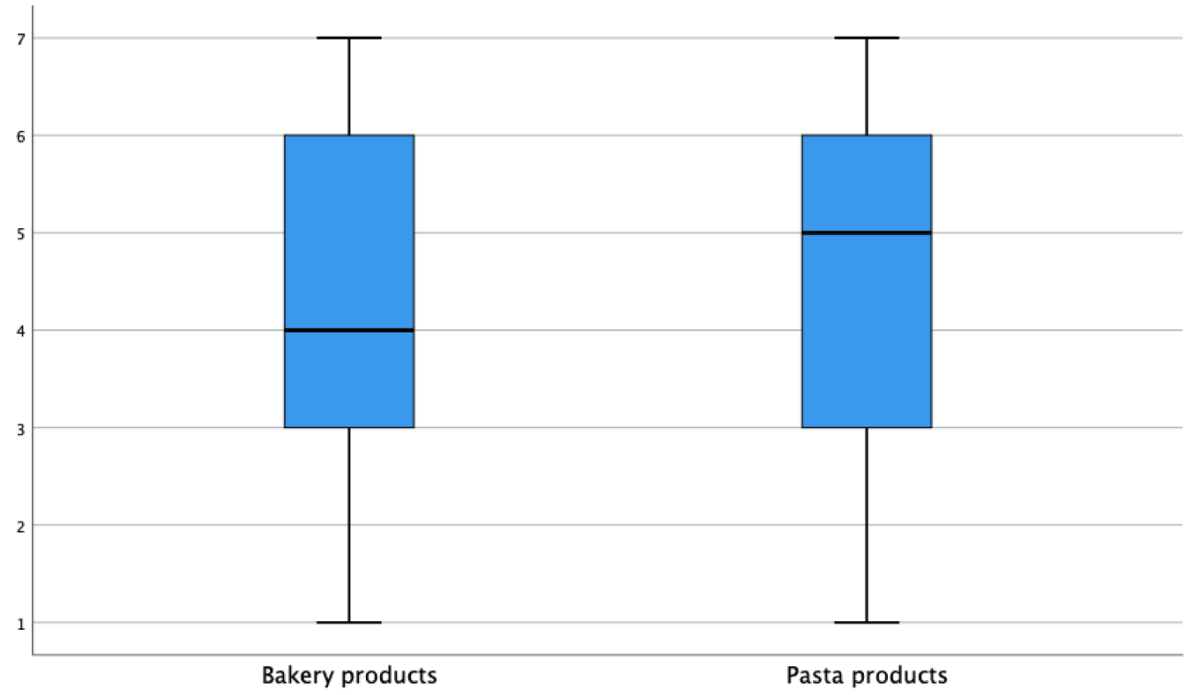

Figure 6.14: The proportion of the population who are more inclined to pay a premium for upgraded bread and pasta products than for regular meals shown in a boxplot.

6.4 Inductive data analysis

According to Myers J.L., et al. (2010), the application of inductive analysis of the data seeks to manage the level of confidence and correlation between two and/or above variables as well as, by extension, to provide answers to the research questions. In order to examine the variance, x^2 analysis seeks to uncover potential variations in the occurrence rates of anticipated replies against those delivered on an ordinal and nominal scale. Using the SPSS IBM Statistics 22.0 tool and the Crosstabs command, in particular, an x^2 analysis was done between the demographics and eating preferences of customers.

Similarly, an x^2 analysis was conducted in order to establish a relationship between the variables pertaining to the factors that drove consumers to adopt a plant-based diet and their demographics. The same was done with neophobia, where factors linked to comments about testing new items were connected with questionnaire demographic data. Demographic variables were also connected with the chance that consumers would incorporate plant protein-enriched foods in their diet or pay a higher premium for them.

As the null hypothesis (H0), it was stated that the values are independent of the factors under examination, while the alternative hypothesis (H1) said that the values are dependent on the variables in question.

The x^2 and p-values regarding consumers' nutritional habits are gathered in **Table 6.16**.

Table 6.16: The x^2 and p values in consumer eating habits correlated with demographic data

NUTRITIONAL HABITS		
VALUES (N=178)	x^2	p -value
AGE	23.108	0.571
PLACE OF RESIDENCE	21.036	0.021
EDUCATION LEVEL	49.578	0.014
PROFESSIONAL SITUATION	19.558	0.190
ANNUAL INCOME	34.140	0.105

As it turns out, the x^2 values associated with age, professional status, and annual income were determined to be non-statistically significant at the 5% level, as p>0.05, so rejecting the null hypothesis that the factors are independent with regard to consumers' eating habits. Therefore, age, professional standing, and yearly income have little effect on the nutritional habits of consumers. In contrast, the x^2 values for the place of residence and education level were found to be statistically significant at the 5% level of significance (p 0.05), hence the null hypothesis is rejected. As these two factors are believed to be interdependent, it may be concluded that the place of residence and education level influence the eating habits of customers.

It was suggested that customers' eating habits are influenced by their area of living. Specifically, it was observed that the majority of the population (N=178) resides in an urban center (N=110), and of these 73 (66.4% within the place of residence) choose to frequently consume all animal sources of protein - meat, such as beef, pork, chicken, turkey, fish and/or shellfish (Omnivore) and then 31 (28.2% within the place of residence) to consume meat occasionally, but try to reduce its consumption and frequently select proteins of plant origin (Flexitarian). 29 (N=44) of the semi-urban center's residents are omnivores, whereas 9 are

flexitarians. 13 of the 24 people in a rural region are omnivores, whereas 8 sometimes eat meat but attempt to minimize their intake and often pick proteins of vegetable origin (Flexitarian). Regarding the remaining dietary habits, the sample size is really tiny. The majority of urban residents favor an omnivorous diet, which is also prevalent in semi-urban and rural settings. Therefore, it is determined that the omnivorous diet surpasses the flexitarian diet by a significant margin, especially in metropolitan and semi-urban locations where alternatives for a plant-based protein diet are deemed more prevalent and accessible.

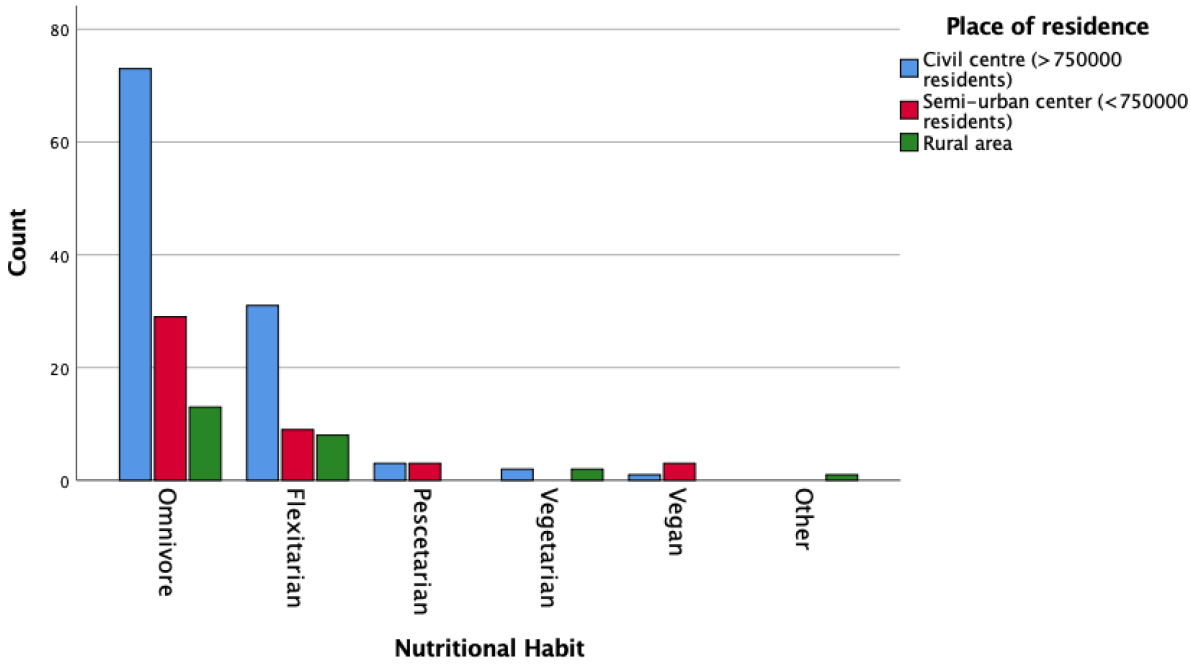

Figure 6.15: Demonstrating the correlation between the place of residence and consumption habits.

The association between factors relating to customers' education level and eating habits is also statistically significant. It is noted that 71.6% of A.E.I./T.E.I. graduates maintain an omnivorous diet, whereas the same kind of diet is followed by 66.1% (of postgraduates) and 66.7% (of doctorate students) (of PhDs). Notable is the fact that 23.5% of graduates adhere to a flexitarian diet, with the proportion of consumers growing with higher levels of education. In particular, 28.8% of postgraduate students and 33.3% of Ph.D. students adhere to a flexitarian diet. However, 33.3% of high school graduates and 25% of I.E.K./D.I.E.C. graduates are also seen to adopt a flexitarian diet, suggesting that education level may not

play such a significant impact on the consumer's choice about eating habits. Regarding the other forms of food, analysis is not worthwhile owing to the tiny sample sizes.

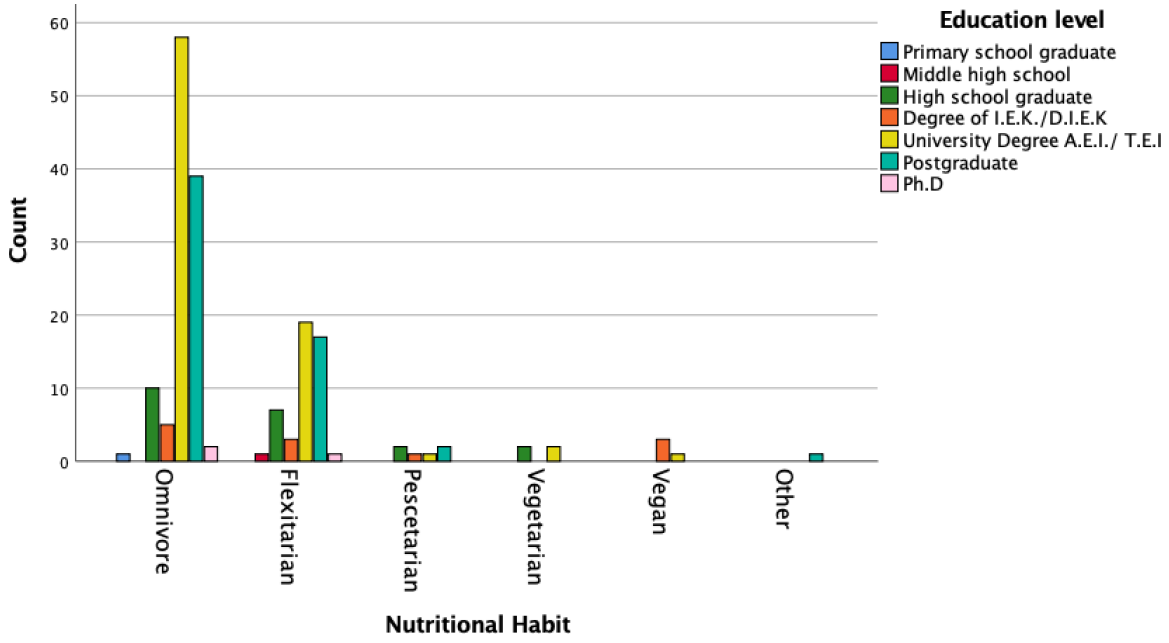

Figure 6.16: Demonstrating the correlation between education level and consumption habits.

In order to assess the elements that impact or might influence the consumer to follow a plant protein-based diet in connection to their demographics, the variables were linked in the same manner (x^2) as described previously. Consequently, as previously, the null hypothesis (H0), was claimed that prices are independent of the variables in issue, but the alternative hypothesis (H1) indicated that prices are dependent on the variables in question. The following **table 6.17** combines the statements about the reasons consumers adopt a plant-based protein diet, as well as the x^2 and values of demographics provided in Table 6.15 and the statements.

Table 6.17: The x^2 and p values for consumer reasons for adopting a plant-based diet correlated with demographic data

REASONS OF INFLUENCE

VALUES (N=178)	x^2	p -value
CONCERNS ABOUT RESOURCE SCARCITY	27.495	0.597

	14.478	0.271
	35.672	0.480
	16.871	0.532
	30.851	0.425
HEALTH (EG IMPROVING PHYSICAL HEALTH,	40.478	0.096
MANAGING DISEASE YEARS)	14.349	0.279
	36.967	0.424
	15.175	0.650
	29.815	0.475
WEIGHT LOSS / WEIGHT MANAGEMENT	37.532	0.162
	6.152	0.908
	41.911	0.230
	17.236	0.507
	39.550	0.114
ETHICAL ISSUES	**50.695**	**0.010**
	12.822	0.382
	33.585	0.584
	16.077	0.584
	34.186	0.237
AVERSION TO ANIMAL PRODUCTS	29.375	0.498
	12.125	0.436
	24.680	0.923
	21.001	0.279
	27.838	.579
FINANCIAL CONCERNS	**43.859**	**0.049**
	7.861	0.796
	28.516	0.808
	19.791	0.345
	18.613	0.948
RELIGIOUS REASONS	19.150	0.790
	8.534	0.577

	24.739	0.738
	11.804	0.694
	35.324	0.083
POLITICAL REASONS	42.152	0.069
	9.316	0.676
	28.918	0.793
	10.934	0.897
	35.419	0.228
FAMILY INFLUENCES	33.027	0.321
	20.818	0.053
	37.733	0.390
	23.438	0.174
	44.807	**0.040**
SOCIAL INFLUENCE	29.585	0.487
	13.729	0.318
	31.465	0.684
	20.404	0.311
	28.904	0.523
INCREASED PURCHASE OF HERBAL	27.361	0.604
PRODUCTS IN SUPERMARKETS	15.316	0.225
	34.715	0.530
	28.120	0.060
	26.461	0.651

As it turns out, almost all $\boldsymbol{x^2}$ values were determined to be non-statistically significant at the 5% significance level, as p>0.05; hence, the aforementioned null hypothesis is not rejected. However, p<0.05 indicates that the numbers 50,695, 43,858, and 44,807 are statistically significant at the 5% significance level, hence the null hypothesis is rejected since the variables are dependent. Thus, these values correspond to the derivative related to ethical issues (e.g. animal rights, animal welfare, the ethical issue with the consumption of animal products) and associated with the age of consumers, to the reasons related to economic concerns (e.g. cost of animal products versus plant-based products) and are related

to age as well as family influences (e.g. regular diet at home, the habit of a particular diet from early childhood, etc.) with the annual income of consumers.

Concerning ethical concerns, especially, 44.4% (N=8) of the 50-59 age group said that ethical issues have no effect on the eating habits of consumers, while 40% (N=8) of the 40-49 age group responded that ethical issues have very little effect. 23.7% (N=23) of the 18-29 age group said that they are neither at all nor very much affected, but 26.5% (N=9) of the 30-39 age group stated that they are not affected in any way. Lastly, 50% (N=4) of the 66-69 age group said that this factor is also very little influenced. Therefore, it is argued that ethical concerns do not have a significant impact on consumers' decisions to eat plant-based proteins regarding age.

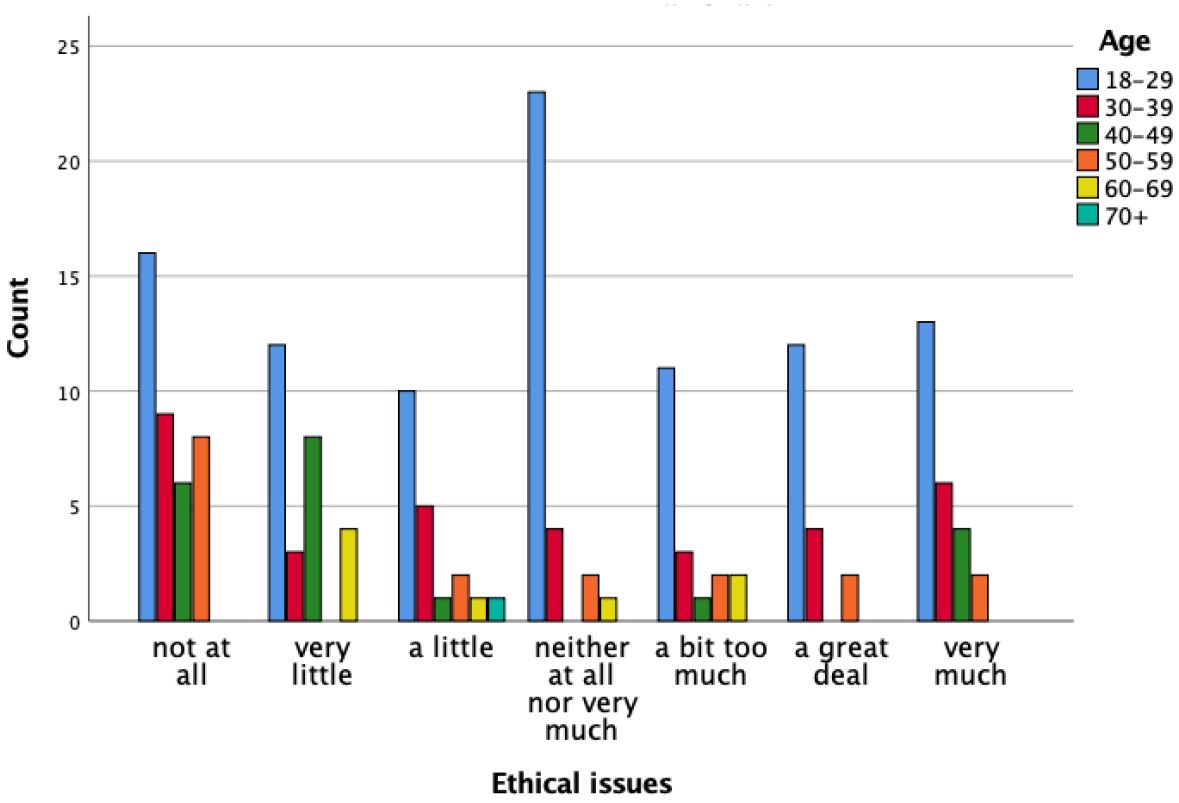

Figure 6.17: Demonstrating the correlation between age and ethical concerns.

As indicated before, it is also worthwhile to analyze statistically the link between the variable pertaining to economic consequences and the age of consumers. Specifically, 62.5% (N=5) of the 60-69 age group said that financial considerations would have very little impact on their decision to adopt a plant-based protein diet, while 33.3% (N=6) of the 50-59 age

group indicated that it is not impacted or was not affected at all. 30% (N=6) of the 40-49 age group reported being unaffected as well, whereas 26.5% (N=9) of the 30-39 age group reported being unaffected just a little. Finally, 21.6% (N=21) of respondents answered that they were neither at all nor very much affected by financial considerations. In general, the cost element does not impact the consumer's decision to eat a diet rich in plant-based proteins. Specifically, it seems that, with the exception of those aged 18 to 29, none of the other age groups had financial worries, which is very acceptable given their ages.

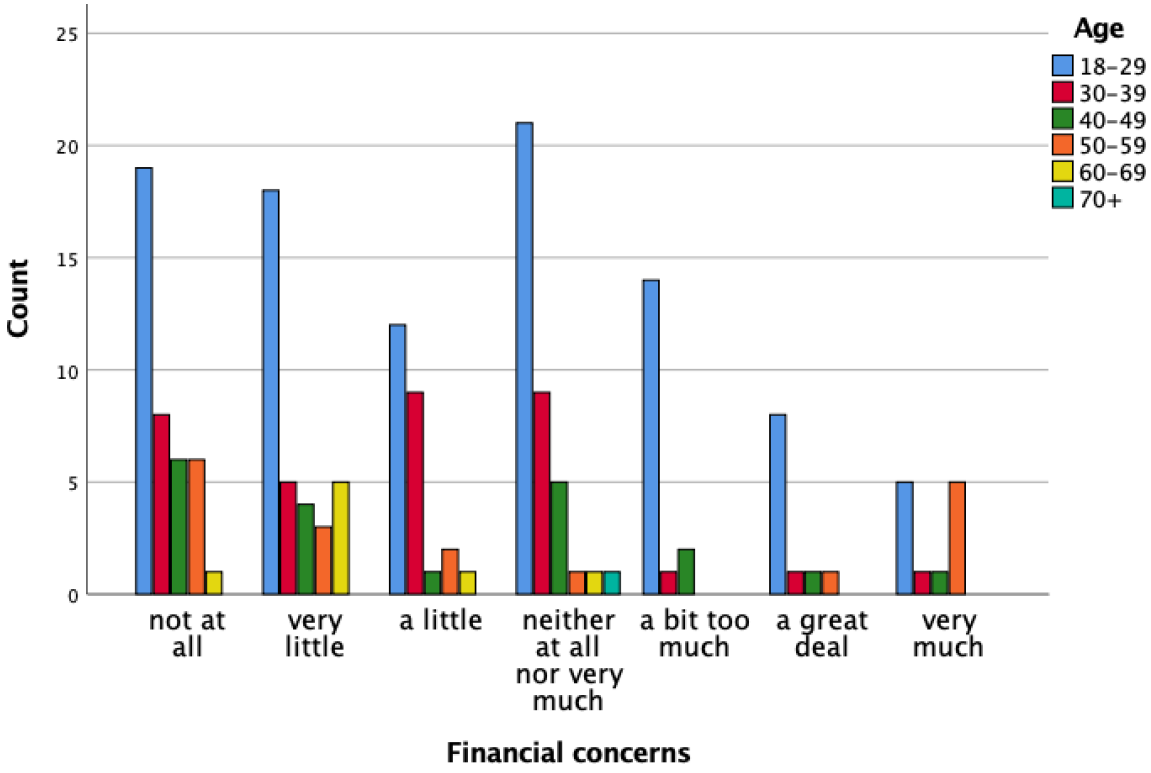

Figure 6.18: Demonstrating the correlation between age and financial concerns

The last statistical study covering the factors that impact or might encourage the customer to adopt a plant-based diet is the relationship between family influences and yearly income. Observations indicate that 45% (N=9) of customers with an annual income of up to €6,000 are very little impacted by familial effects. Similarly, 38.5% (N=20) of those with an annual income between €12,000 and €240,000 and 38.1% (N-8) of those with an annual income between €24,000 and €50,000 said that they are not at all impacted by familial factors. 25% (N=16) of customers with an annual income between €6,000 and €12,000 indicated the same. In conclusion, it was determined that the specific statistical analysis, even if it was statistically

significant according to the x^2 test, does not produce objective results because the correlation between variables pertaining to annual income and family influences is not comparable enough to draw significant conclusions for the present study.

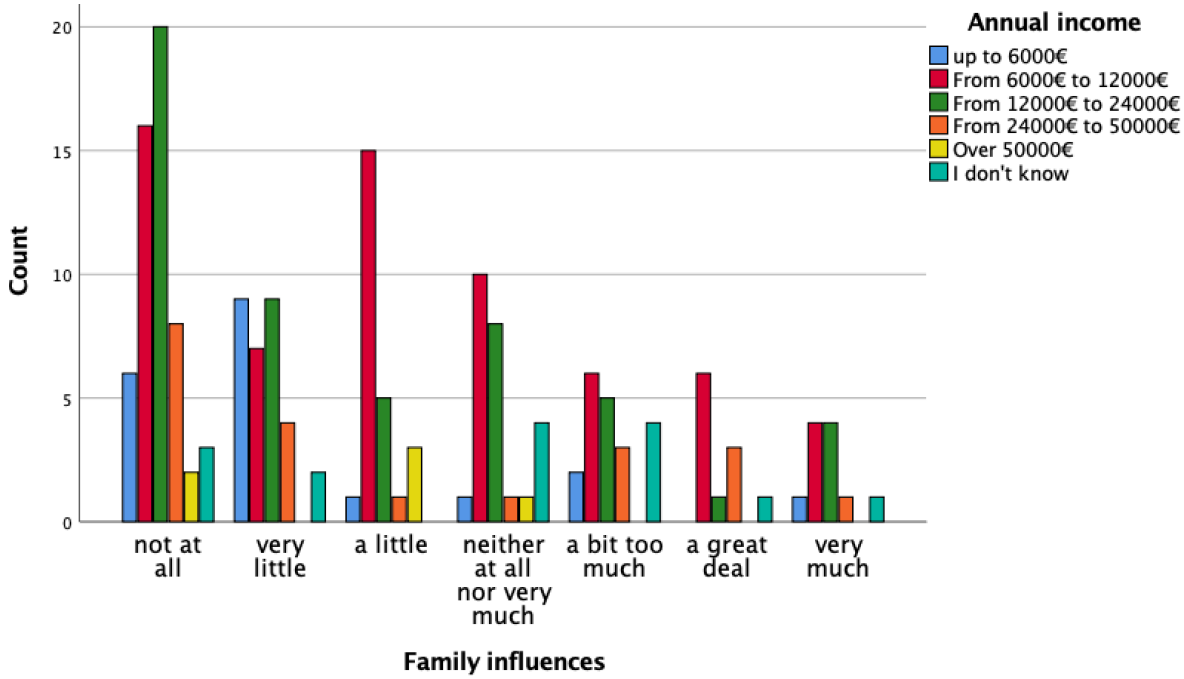

Figure 6.19: Demonstrating the correlation between annual income and family influences.

Similarly, characteristics associated with neophobia statements and demographic data were connected in order to address the research questions posed by the current study. Thus, the null hypothesis (H0) said that the values are independent of the variables in issue, but the alternative hypothesis (H1) demonstrated that the values are dependent on the factors in question. The following **Table 6.17** combines the neophobia-related statements with the values of x^2 and the demographic statistics as shown in Table 6.15.

Table 6.18: The x^2 and p values for neophobia statements correlated with demographic data

NEOPHOBIA VALUES (N=178)	x^2	p -value
I AM CONSTANTLY TRYING NEW AND	40.965	0.087
DIFFERENT FOODS	10.694	0.555

	37.542	0.398
	22.177	0.224
	45.151	**0.037**
I DON'T TRUST NEW FOODS	33.575	0.298
	9.945	0.621
	15.561	0.999
	26.125	0.097
	47.716	**0.021**
IF I DON'T KNOW WHAT'S IN A FOOD, I	**44.658**	**0.042**
WON'T TRY IT	14.098	0.294
	42.301	0.217
	22.437	0.213
	29.331	0.500
I LIKE FOOD FROM DIFFERENT	31.943	0.370
COUNTRIES	15.288	0.226
	61.252	**0.005**
	23.648	0.167
	41.700	0.076
ETHNIC CUISINES LOOK VERY STRANGE	36.368	0.196
	11.023	0.527
	23.292	0.950
	19.696	0.350
	45.114	**0.038**
AT DINNERS, I TRY NEW FOODS	42.840	0.061
	20.033	0.066
	59.925	**0.007**
	21.424	0.259
	48.003	**0.020**
I'M AFRAID TO EAT THINGS I'VE NEVER	38.702	0.133
EATEN BEFORE	**25.250**	**0.014**
	28.279	0.817

	26.024	0.099
	31.222	0.405
I AM VERY PARTICULAR ABOUT THE FOOD I WILL EAT	**57.450**	**0.002**
	18.832	0.093
	41.097	0.257
	19.780	0.345
	23.641	0.788
I WILL EAT ALMOST ANYTHING	25.065	0.722
	13.488	0.335
	37.171	0.415
	13.475	0.763
	30.255	0.453

As a result, the aforementioned null hypothesis is not rejected since practically all x2 values were found to be non-statistically significant at the 5% significance level, as p>0.05. The null hypothesis is rejected since the variables are dependent and p0.05 shows that the values 45.151, 47.716, 44.658, 61.252, 45.114, 59.925, 48.003, 25.250 and 57.450 are statistically significant at the 5% significance level. Therefore, these variables are related to the relationship between the statements “I like food from different countries” with the level of education, “ Ethnic cuisines look very strange” with the annual income, “At dinners, I try new foods” with the level of education as well as the annual income, “I don’t trust new foods” and the annual income as well, “if I don’t know what’s in a food, I won’t try” with the age, “I am afraid to eat things I’ve never eaten before” with the place of residence as well as “I am very particular about the food I will eat” with the age.

Regarding the statement “I am constantly trying new and different foods”, 38.8% of the people (N=8) with an annual income between €24,000 and €50,000 strongly agreed, while 26.6% of those with an annual income between €6,000 and €12,000 also strongly agreed. 30% (N=6) of customers with an annual income of up to €6,000 slightly agreed with the statement, whereas 17.3% (N=9) of those with an annual income between €12,000 and €24,000 slightly agreed and just agreed. We may claim that when the yearly income of consumers rises, a greater proportion of respondents agree that they try new meals. Notable also is the fact that

regardless of yearly income, the whole research sample reacted favorably to the above statement.

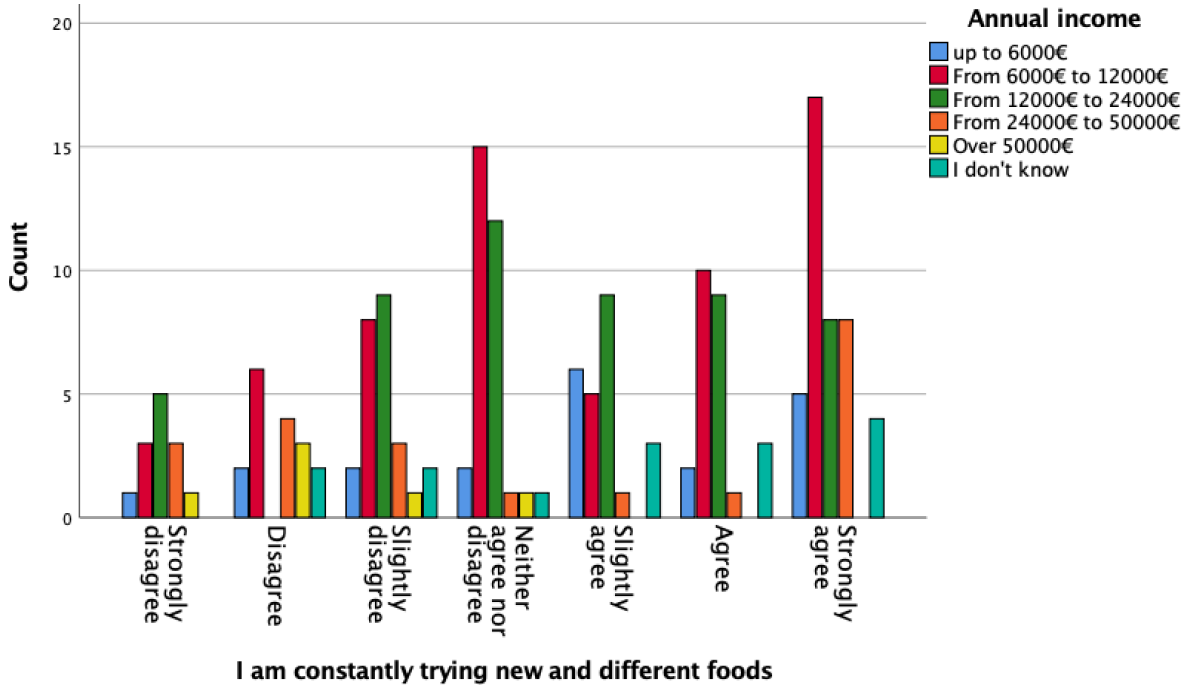

Figure 6.20: Demonstrating the correlation between the statement "I am constantly trying new and different foods" and annual income.

40% (N=8) of customers with an annual income of up to €6000 express both strong disagreement and disagreement with the statement, "I don't trust new foods," using the same line of reasoning as shown in **figure 6.21**. 38.1% (N=8) of those with an annual income between €24,000 and €50,000 strongly distagreed, as did 35.9% (N=23) of those with an annual income between €6,000 and €12,000 and 30.8% (N= 16) of those with an annual income between €12,000 and €24,000. Lastly, 66.7% (N=4) of those with a yearly salary of above €50,000 slightly disagreed. It is determined that yearly income has no impact on the people's faith in new foods and that the population studied has trust in novel foods.

Regarding the statement "if I don't know what's in food, I won't try it," 33.3% (N=6) of the 50-59 age group agreed strongly. 25% (N=5) in the age group 40-49 agreed. 29.4% (N=10) of the 30-39 age group said that they slightly agreed with the statement, whilst 19.6% (N-19) of the 18-29 age group disagreed with the statement. Finally, it is notable that 50% (N=4) of those aged 60 to 69 likewise expressed disagreement seems that the older a client is, the more they dread ingesting products with unknown food ingredients.

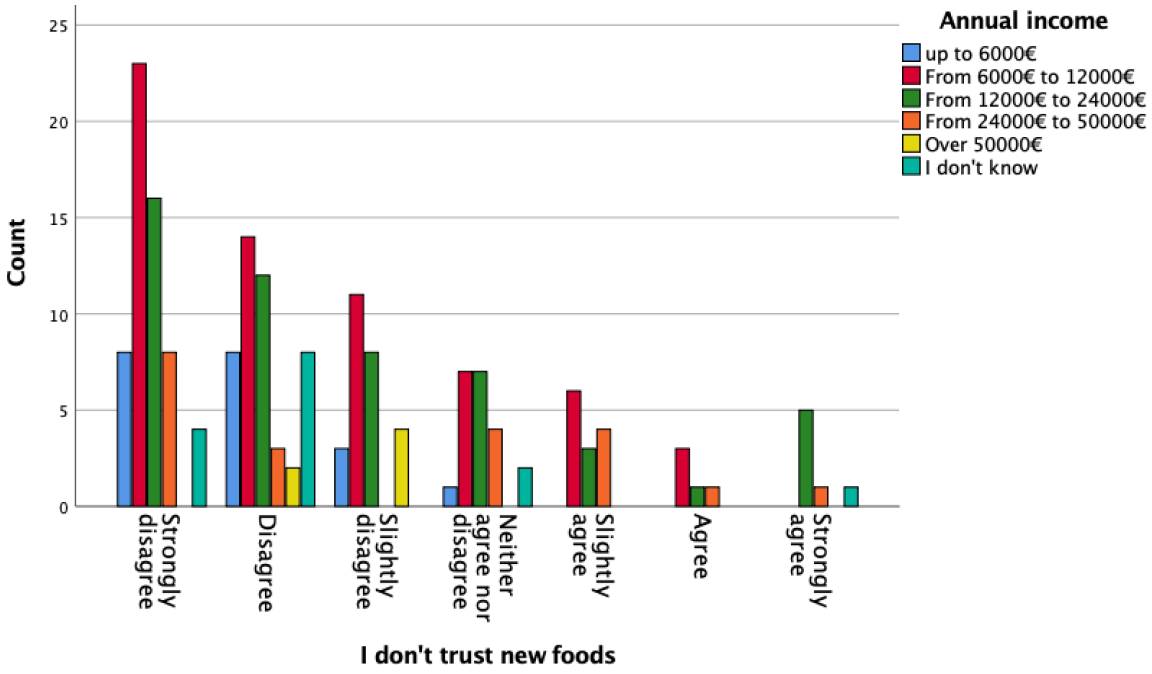

Figure 6.21: Demonstrating the correlation between the statement "I don't trust new foods" and annual income.

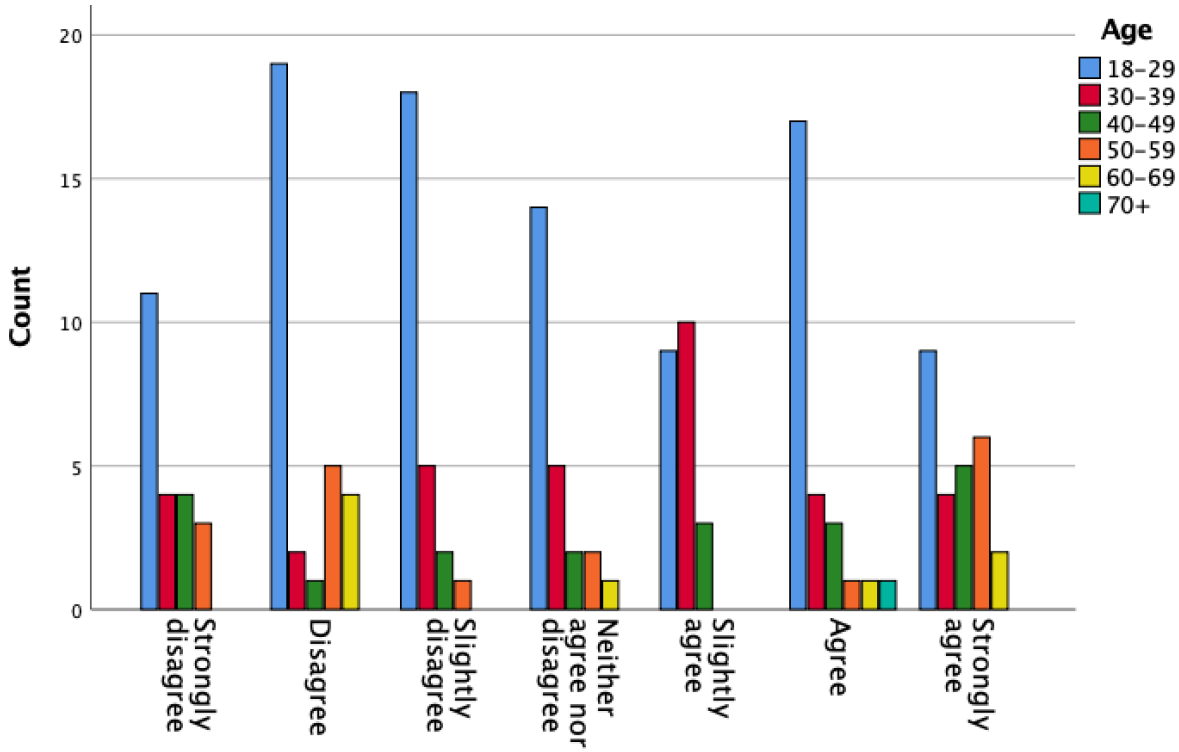

Figure 6.22: Demonstrating the correlation between the statement "If I don't know what's in a food, I won't try it" and age.

Figure 6.23 addresses the statement "I like food from different countries" and its link with the education level of the people, 58.3% (N=7) of the I.E.K./D.I.E. graduates and 30.9% (N=25) of the AEI/TEI graduates said that they strongly agree with the statement. 35.5% (N=21) of postgraduates and 33.3% (N=7) of high school graduates responded identically. Therefore, it is determined that the level of education has no part in the public's preference for cuisine from other countries and that the public, regardless of their degree of education, enjoys food from different countries.

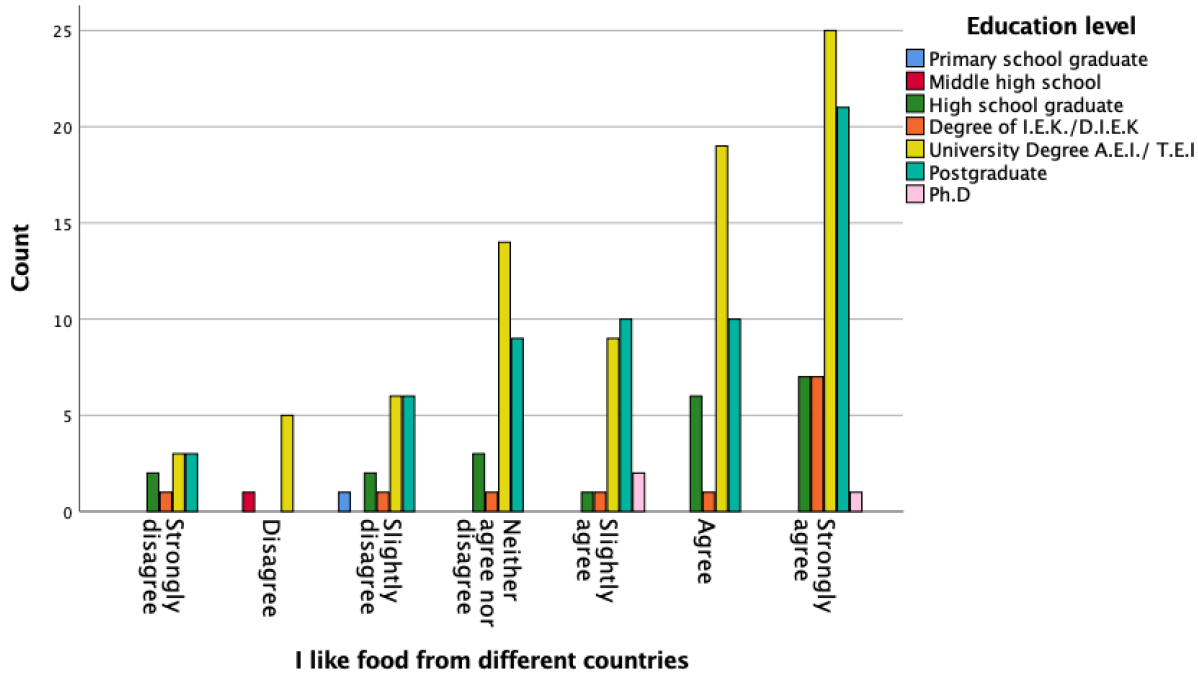

Figure 6.23: Demonstrating the correlation between the statement "I like food from different countries" and education level.

It is noteworthy that practically the whole community disagrees with the statement "Ethnic cuisines look very strange." In particular, 50% (N=10) of customers with an annual income of up to €6000 disagree with the statement, while 43.8% (N=28) disagree strongly. Similarly, 36.5% (N=19) of those with an annual income between €12,000 and €24,000 and 33.3% (N=7) of those with an annual income between €24,000 and €50,000 strongly disagreed. Lastly, 50% (N=3) of customers with an annual income in excess of €50,000 said that they slightly disagree with the statement. It is noticed that customers, regardless of their yearly income or financial status, agree that ethnic foods are not strange.

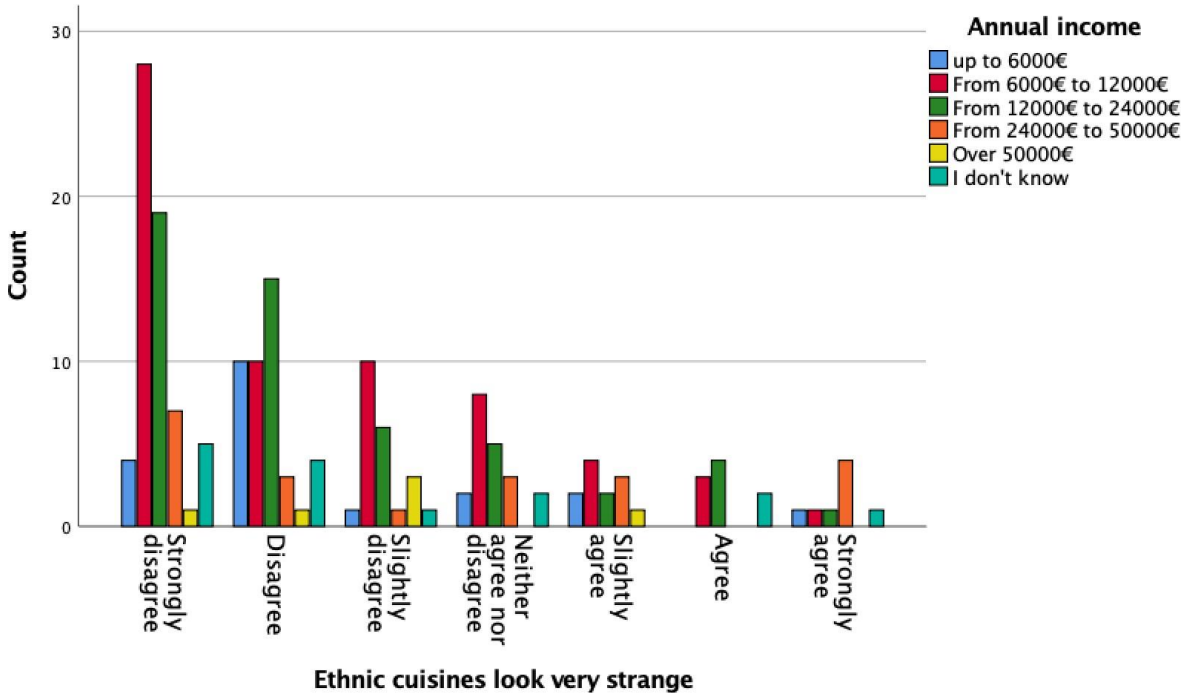

Figure 6.24: Demonstrating the correlation between the statement "Ethnic cuisines look very strange" and annual income.

The relationship between the statement "At dinners, I try new foods" and two demographic variables, education level, and yearly income were examined (**Figure 6.24**). As a result, regarding the first correlation, 33.3% (N=4) of I.E.K./D.I.E.K. graduates and 33.3% (N=1) of the teaching staff indicated strong agreement with the statement. Likewise, 32.2% (N=19) of the post-grads and 29.6% (N=24) of the A.E.I./T.E.I. graduates expressed strong agreement with this statement as well. Finally, 33.3% (N=7) of high school graduates agreed with the statement without qualification. Therefore, it is inferred that consumers with higher levels of education are more willing to try new cuisines than high school graduates, who are also willing to do so with some reluctance.

Regarding the same statement in reference to annual income, 34% (N=22) of consumers with an annual income between €6,000 and €12,000 said they strongly agree with trying new foods at dinners, but also 33.3% (N=7) of those with an annual income between €24,000 and €50,000 said the same thing. Lastly, 25% (N=13) of those with an annual income between €12,000 and €24,000 and 25% (N=5) of those with an annual income of less than €6,000 responded in the affirmative. It seems that yearly income does not impact trying new foods

experimentation among consumers. Notably, 40% (N=6) of the population who responded that they do not know their yearly income agreed with the assertion as “slightly agree”.

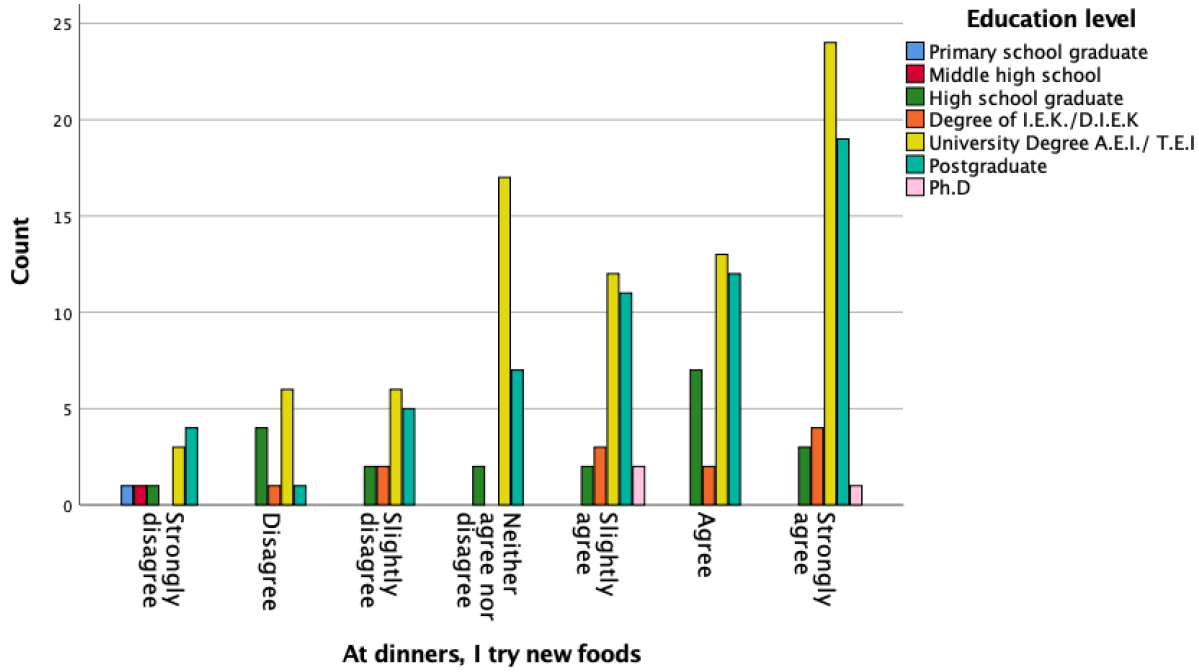

Figure 6.25: Demonstrating the correlation between the statement “At dinners, I try new foods” and education level.

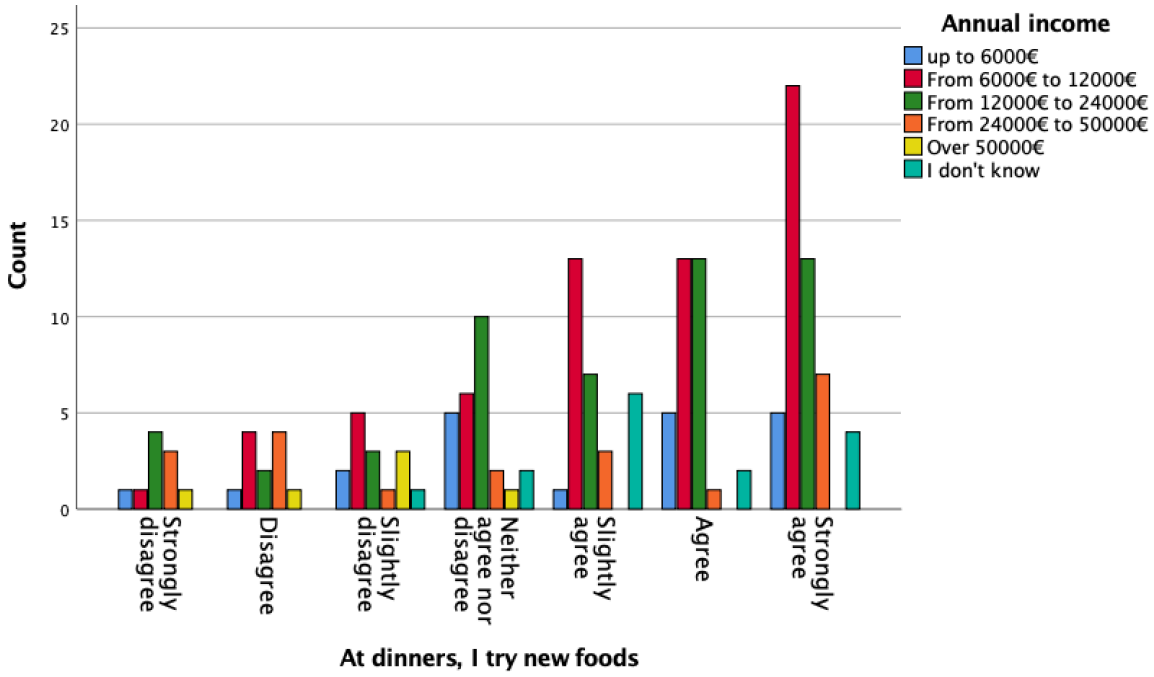

Figure 6.26: Demonstrating the correlation between the statement “At dinners, I try new foods” and annual income.

The relationship between factors pertaining to the sentence "ι'm afraid to eat things I've never eaten before" and the demographic variable "place of residence" was also deemed statistically significant. Thus, 37.3% (N=41) of urban-dwelling customers disagreed strongly, while 30.9% (N=34) just disagreed. Regarding customers who reside in a semi-urban center, 27.3% (N=12) disagreed strongly, while 22.7% (N=10) just disagreed. In the same manner, 33.3% (N=8) of rural residents absolutely disagree, while 20.8% (N=5 disagree. Thus, it may be concluded that customers who reside in urban areas are less hesitant to try new meals than consumers who reside in semi-urban and rural areas, who similarly responded negatively to the statement but had a lower level of faith in these foods.

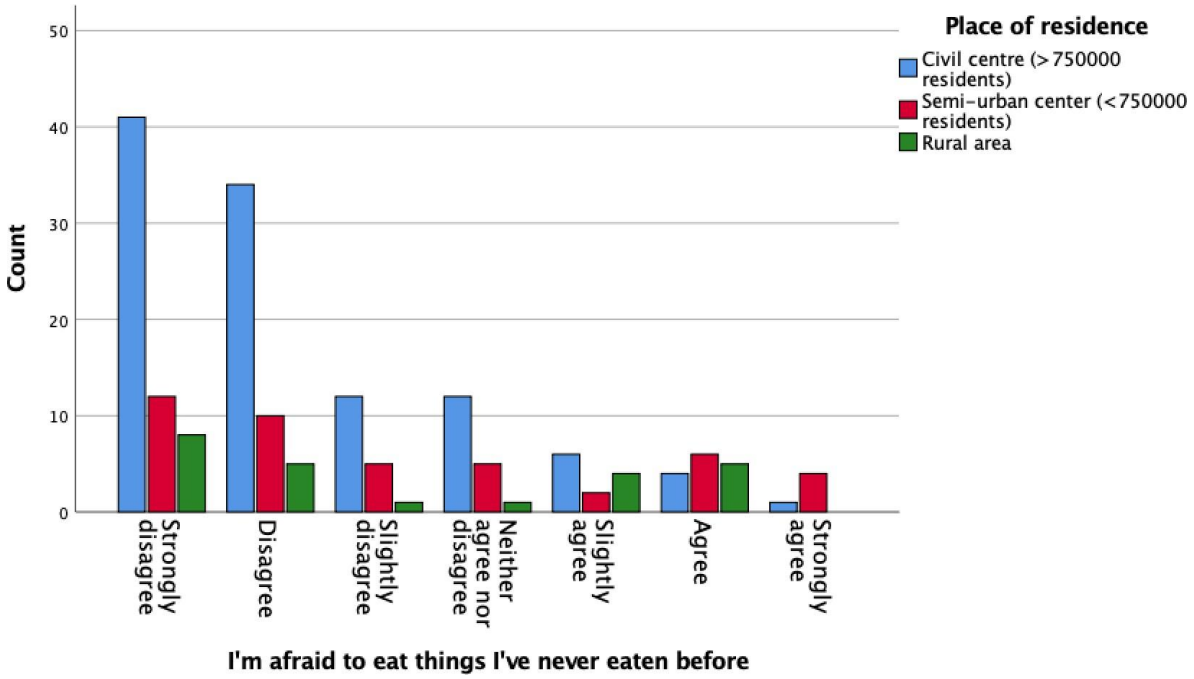

Figure 6.27: Demonstrating the correlation between the statement "I'm afraid to eat things I've never eaten before" and place of residence.

The last significant link is between the phrase "I am very particular about the food I will eat" and the age of the customers. Specifically, 44.4% (N=8) of the 50-59 age group disagreed strongly with the statement, but 38.9% (N=7) of the same age group neither agreed nor disagreed. Similarly, 39.2% (N=38) of the 18-29 age group said they disagreed strongly, while 17.5% (N=17) said they slightly disagreed. 26.5% (N-9) of those between the ages of 30 and 39 disagreed strongly with the statement, whereas 20.6% (N=7) of those in this age range slightly agreed. Regarding the age group 40-49, 25% (N=5) do neither agree nor disagree,

whilst 20% (N=4) disagree. In contrast, fifty percent (N=4) of the 60-69 age group disagreed. Therefore, it has been shown that as consumers age, they get pickier about their food preferences, despite these variations not being statistically significant. We may deduce that younger individuals are less picky eaters than their elder counterparts.

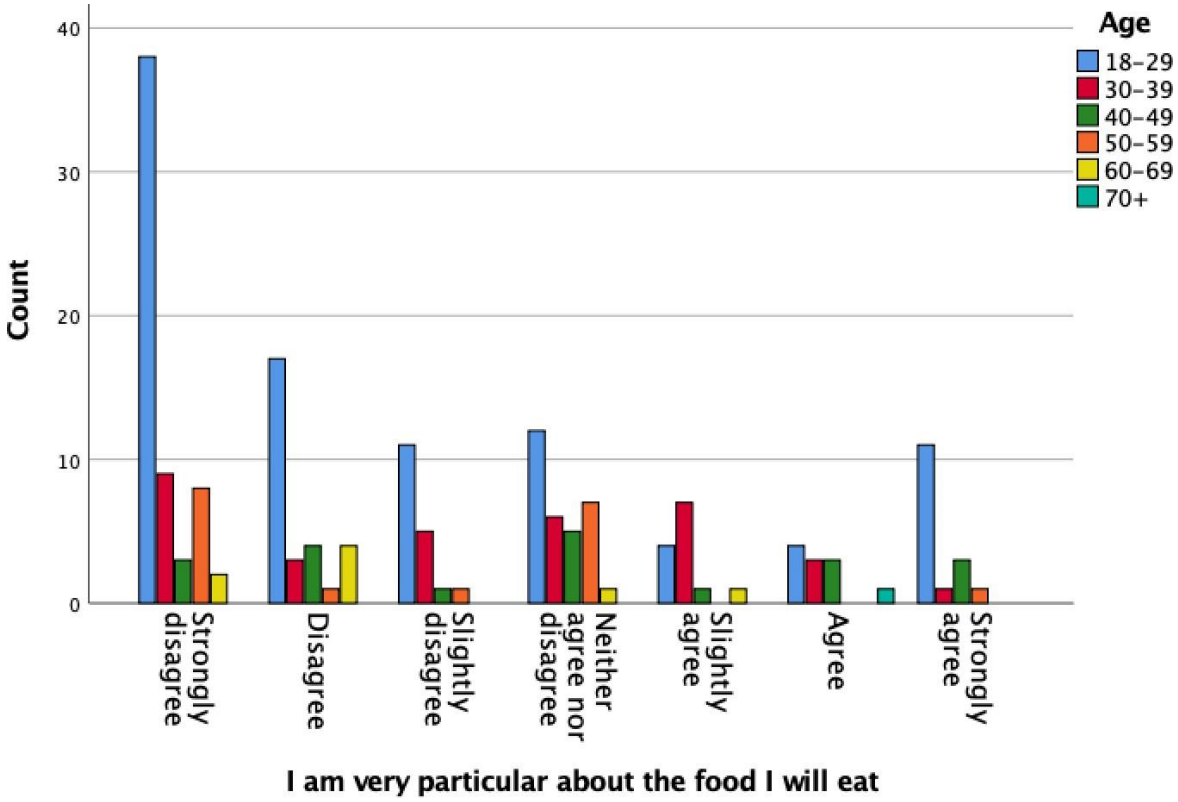

Figure 6.28: Demonstrating the correlation between the statement "I am very particular about the food I will eat" and age.

In order to determine whether or not customers will be willing to spend more for reinforced goods Meat (beef, pig, poultry, lamb, etc.), cold cuts, fish, milk, cheese, yogurt, eggs, pasta, and bakery goods were all related to the demographics in the same manner (x2) as previously mentioned. As a result, the alternative hypothesis (H1) demonstrated that the values rely on the variables under consideration, contrary to the null hypothesis (H0), which maintained that the values are independent of the variables under consideration. The numbers and data from Table 6.15 are combined with the enriched meals, x2, and the subsequent **Table 6.19**.

Table 6.19: The x^2 and p values for fortified foods correlated with demographic data

FORTIFIED FOODS

VALUES (N=178)	x^2	p -value
MEAT (BEEF, PIG, POULTRY, LAMB, ETC.)	20.936	0.890
	6.446	0.892
	28.706	0.801
	18.558	0.420
	22.244	0.845
COLD CUTS	20.568	0.901
	12.650	0.395
	22.812	0.957
	14.491	0.697
	29.051	0.515
FISH	18.207	0.955
	10.124	0.605
	31.971	0.661
	10.110	0.928
	25.147	0.718
MILK	25.513	0.700
	5.292	0.947
	27.806	0.834
	15.652	0.617
	26.860	0.631
CHEESE	28.640	0.537
	2.668	0.997
	31.446	0.685
	12.947	0.795
	20.836	0.893
YOGURT	25.079	0.721
	7.533	0.820

	36.363	0.452
	20.715	0.294
	15.795	0.984
EGGS	27.118	0.617
	10.266	0.593
	38.150	0.372
	14.721	0.681
	27.864	0.578
PASTA	**46.018**	**0.031**
	5.802	0.926
	47.668	0.092
	26.226	0.095
	35.342	0.230
BAKERY GOODS	**47.369**	**0.023**
	6.352	0.897
	43.277	0.189
	21.189	0.270
	27.358	0.604

Given that p>0.05 and all of the x2 values for meals having animal proteins were found to be non-statistically significant at the 5% level, the aforementioned null hypothesis is not denied. But in the case of fortified pasta goods, the null hypothesis is not disproved because the x2 value is 46.018 and the p-value is 0.031, indicating that the factors are interdependent. The same is true for bakery goods, where a value was discovered for the x2 value of 47.369 which had a p-value of 0.023.

In particular, 59.8% of respondents in the 18-29 age category indicated that they would be willing to spend more for pasta goods that were enhanced with plant-based proteins. While 16.5% (N=16) and 14.4% (N=14) of them said they would possibly pay and strongly possibly pay, respectively, 28.9% (N=28) of them said they would slightly possibly pay. The 30-39 age group replied favorably to the same options with a lower proportion of 50%, whereas the 40-49 age group gave responses of 30% (N=6), 15% (N=3), and 15% (N=3) for the likelihood of paying to purchase enhanced pasta. Age groups 50–59 responded favorably with

a percentage of 38.9%, while those 60–69 responded favorably with a percentage of 25.5%. Therefore, it can be said that customers appear to mistrust reinforced goods as they get older. The proportion of respondents in the 40–49 age range who gave favorable answers is thought to be arbitrarily greater because so few people in the research population fell into this age category.

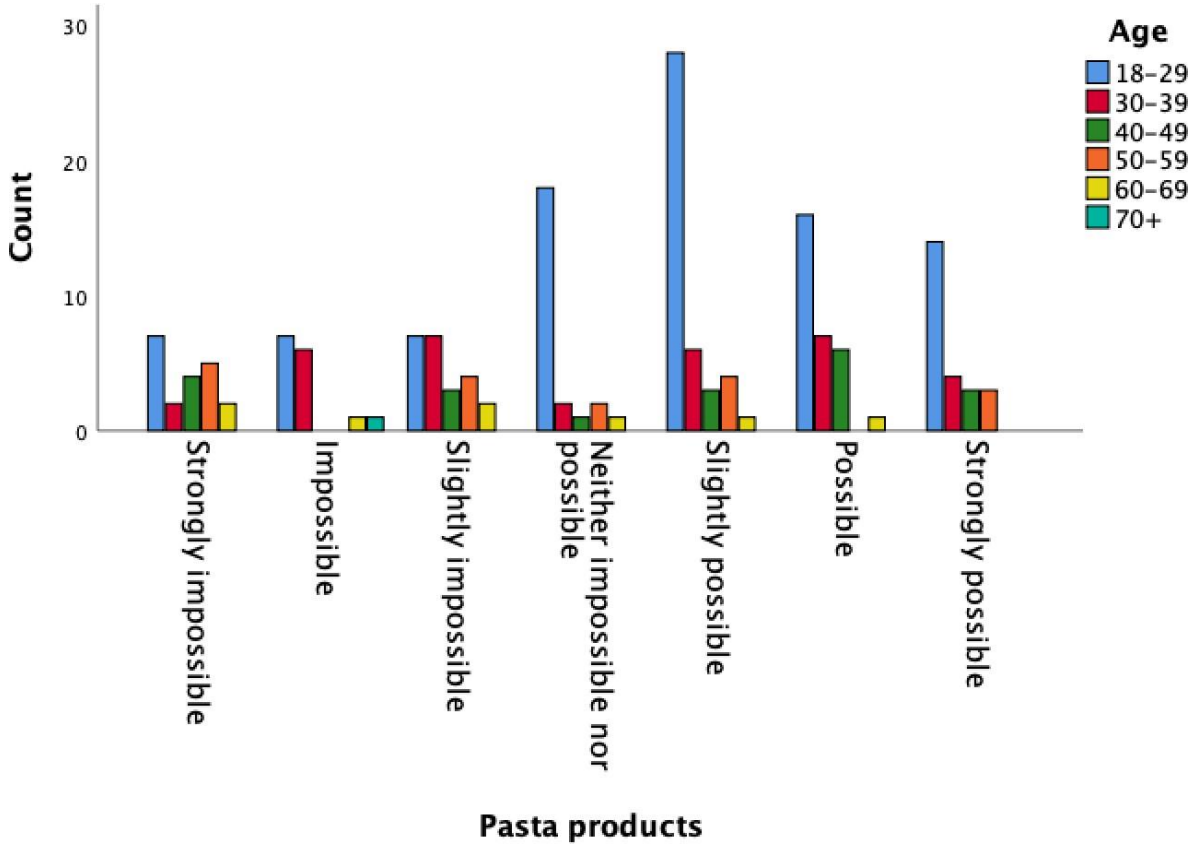

Figure 6.29: Demonstrating the correlation between enriched pasta products and age.

Finally, 54.6% of respondents between the ages of 18 and 29 were in favor of purchasing enriched bakery products. Specifically, 24.7% (N=24) of this age group reported that it is marginally possible, 17.5% (N=17) reported that it is just possible, and 12.4% (N=12) reported that it is strongly possible. Also, within the 30-39 age cohort, 11.8% (N=4) said it is marginally possible, 14.7% (N=5) said it is just possible, and 17.6% (N=6) said it is strongly possible. Similarly, 55.6% of respondents in the 50–59 age group responded negatively, whereas 55% of respondents in the 40–49 age group responded positively when asked about spending

more on enhanced baked products. It has been discovered that as consumers age, they become less receptive to these products and more selective about them.

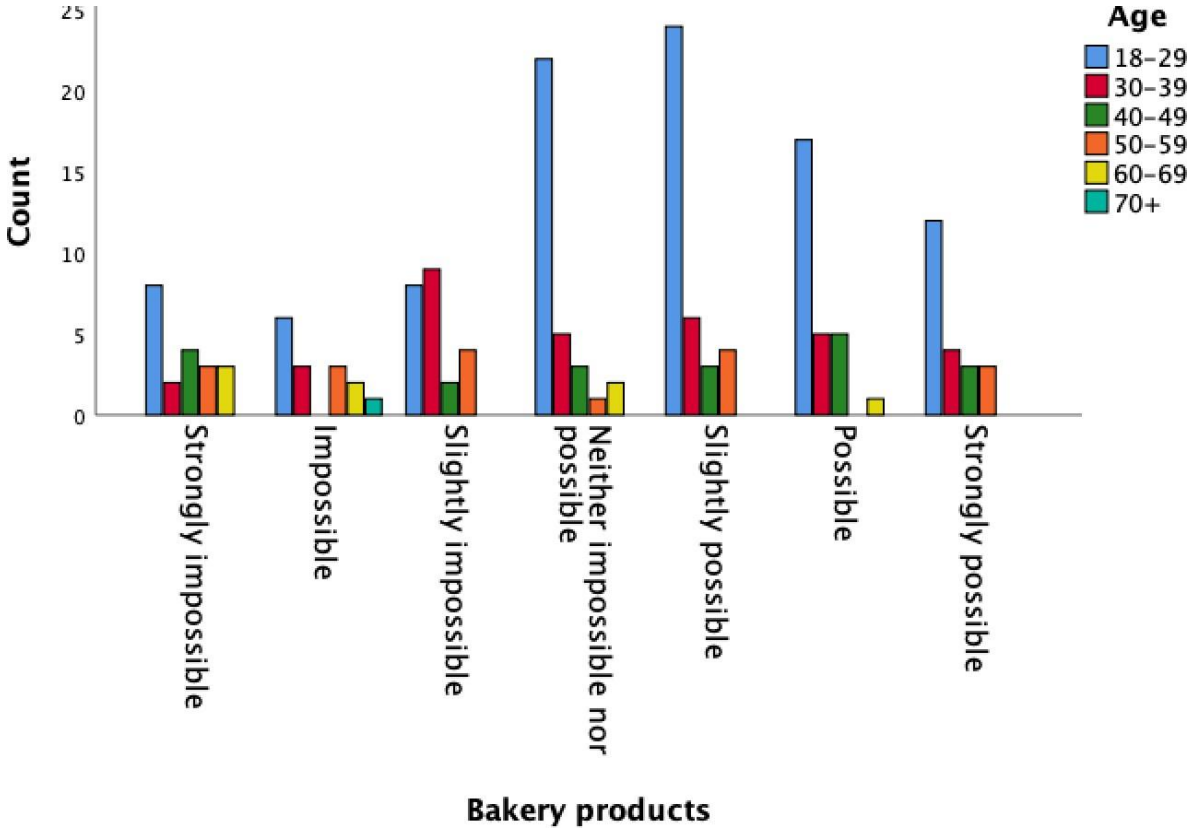

Figure 6.30: Demonstrating the correlation between enriched bakery products and age.

7. CONCLUSIONS

The ultimate goal of the research was outlined in the earlier chapters of this study, which were then followed by a thorough analysis of the pertinent literature on the significance of the protein component in food, different dietary patterns, consumer groups, and the state of alternative protein research at the time. both locally and internationally.

The study topics were then outlined, and the technique used was examined. This chapter also interprets and summarizes the key findings that came from the statistical analysis of the data, and it gives responses to the research questions in connection to the outcomes that were discovered. Naturally, one must consider both the research's limits and the particulars of the instance under examination while drawing conclusions.

Finally, prospective future research possibilities are discussed, which may serve as a springboard for drawing the attention of other researchers interested in continuing the investigation of alternative protein sources in the food and beverage industry.

7.1 Review of aims and main findings

The study's findings also showed how crucial findings affect people's attitudes toward and acceptance of plant proteins, while more research was done on the variables affecting people's willingness to pay for plant proteins. They are, in brief, as follows:

One of the most significant variables influencing people's decision to purchase food is their desire to keep or better their health. This is because they want to prevent making poor nutritional decisions. One is that selecting plant proteins is primarily influenced by health.

Notably, a significant proportion of consumers appear to be concerned with ethical issues (e.g., animal rights, animal welfare, ethical issues with the consumption of animal products) and, as a result, have a greater affinity for the consumption of plant-based foods.

Food neophobia appears to be significantly reduced by the conviction that plant protein is healthy for the body. It is simpler to dispel people's skepticism about establishing new dietary habits when they are provided with accurate information, easy access to information, and awareness of the mounting issues confronting the world.

Although it is much simpler to locate and choose different meals in metropolitan areas, geography does not appear to have an impact on customer dietary patterns. It was also established that customers, to a greater or lesser degree, are omnivores and that their dietary patterns are unaffected by their level of schooling, regardless of that level.

In addition, it seems that, with the exception of those aged 18 to 29, none of the other age groups had financial concerns, which is perfectly acceptable given their age, when it came to factors that influenced or would influence consumers' decision to follow an exclusively sustainable plant-based diet.

Regarding neophobia, we can assert that as the annual income of consumers increases, a greater proportion of respondents concur that they attempt novel foods. Notable is also the fact that regardless of annual income, the entire survey sample responded affirmatively to both statements "I am constantly trying new and different foods" and “ethnic foods are not strange”. Additionally, elderly age groups appear to have a stronger attachment to the flesh,

which discourages them from attempting plant-based proteins. It is therefore evident that these age groups require time and find it especially challenging to acquire new dietary habits. Thus, Food Neophobia has a greater impact on older age groups and discourages them from trying new foods and developing new eating habits.

Finally, it can be said that as people get elderly, they seem to have less faith in bakery and pasta goods that have been reinforced. Consumers have been observed to become less open to and pickier about these goods as they get older.

7.2 Research limitations

Readers and researchers should be aware that the findings of this study are constrained in some ways. The research makes reference to a topic that has recently gained significant attention in other nations but has not yet had a significant impact on our nation or its citizens. Despite being extremely health mindful and appearing to be worried, consumers in our nation are largely unaware of plant-based foods. As a result, there are no prior studies that provide sufficient information on Greek customers' consumption habits or intentions.

However, the management and marketing of plant-based foods by businesses, as well as the strategies they will employ, are at a very advanced level in our nation, which has had a restricting effect on the study. The particular significant variables linked to the financial success of the goods will be further and in-depth analyzed because there is a dearth of comprehensive financial data (eg profit margins, etc.).

Additionally, it may be challenging to understand how the ideas of food neophobia function because they are not widely accepted. The research population, which was mostly made up of people who were youthful and lived in the Attica Region, is another element that is likely to have an impact on the study's findings. Finally, a questionnaire was used to gather the data. This limited the potential of revisions and justifications of the provided responses.

7.3 Practical extensions

This essay explored both the factors that might influence a consumer's decision to purchase plant-based foods as well as the factors that might discourage them. The benefits and drawbacks of plant-based dietary options were also enumerated.

Additionally, a customer profile that has the greatest likelihood of selecting a particular plant meal is created based on the general questions as well as the other questions.

In terms of how they decide to advertise and convey their plant-based goods to consumers, these results can be a useful tool for businesses that will be involved in the plant-based food industry. They should concentrate on pushing the messages that the study indicates consumers favor. Businesses will also be aware of the target market's consumer audience, including their preferences and objections, as well as the areas in which they should concentrate their efforts to connect with new consumer groups with distinct characteristics. This will enable them to broaden the market's consumer audience.

Last but not least, the current work has the potential to educate and prepare a number of potential future customers, who will favor plant-based foods due to the benefits that eating them offers both to the body and the ecosystem.

7.4 Suggestions for future research

The current thesis can serve as a springboard for further investigation, which would be very fascinating to see if it could offer solutions to various problems that have come up or that could not be looked into and to reach more certain findings. It is evident, however, that even though many intriguing components showed up and were assessed and analyzed using the literature at the time, there are undoubtedly more analyses, tests, and readings that could be made using the data already gathered. They could therefore be viewed as follows:

a) According to the results of the other polls mentioned, there is no apparent difference between metropolitan areas and the rest of the regions in terms of readiness to purchase plant-based beef.
b) Although not as powerful as anticipated and with no connection to readiness to spend more for plant-based beef, higher wealth does demonstrate a favorable association with the desire to purchase.
c) Contrary to international literature, which asserts that environmentalist arguments prevail because consumers are more aware of environmental protection, the survey found that the only factors that would motivate consumers to follow an exclusively sustainable plant-based diet were ethical and health concerns.

d) Further research into the hesitation to pay for plant-based beef that drove the bulk of the poll group would also be of special interest.

For the purpose of the intended practical actions, it is considered essential to conduct a comparable quantifiable study on a national and foreign scale. In order to develop a useful tool for future strategic actions from an operational point of view, the current study could be conducted for other alternative protein sources (insects, algae, meat in vitro) and their application in the food and beverage sector, as well as for other categories of novel and non-food products/ingredients. In order to correlate the findings of this poll with those of future studies of a comparable nature would be fascinating.

There are a lot of paths for additional research on the use of plant protein sources in the food and beverage industry, according to the research subjects that were given as well as those that each reader can infer from reading the current article. Additionally, because the market and customer requirements are dynamic and constantly changing, it is frequently impossible to continuously watch developments, some results have a brief shelf life, and some phenomena are only partially or inadequately evaluated.

In conclusion, future scholars who focus on this specific study subject will greatly advance our understanding of business strategy in the food and beverage industry.

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ΟΙ ΑΝΤΙΛΗΨΕΙΣ ΚΑΙ ΟΙ ΑΠΟΨΕΙΣ ΤΟΥ ΚΑΤΑΝΑΛΩΤΗ ΣΧΕΤΙΚΑ ΜΕ ΤΑ ΤΡΟΦΙΜΑ ΦΥΤΙΚΗΣ ΠΡΟΕΛΕΥΣΗΣ

Σκοπός της παρούσας έρευνας είναι να μελετηθούν οι αντιλήψεις και οι απόψεις των καταναλωτών σχετικά με τα τρόφιμα φυτικής προέλευσης τα οποία καταναλώνονται ως εναλλακτικές της ζωικής πηγής πρωτεΐνης. Η έρευνα διεξάγεται στο πλαίσιο εκπόνησης διπλωματικής εργασίας στο Πρόγραμμα Μεταπτυχιακών Σπουδών «Τρόφιμα, Διατροφή και Υγεία» του Τμήματος Επιστήμης Τροφίμων και Διατροφής του Ανθρώπου του Γεωπονικού Πανεπιστημίου Αθηνών. Η συμβολή σας στην διεξαγωγή της έρευνας είναι ιδιαίτερα σημαντική.

Το ερωτηματολόγιο έχει αδειοδοτηθεί από την Επιτροπή Ηθικής και Δεοντολογίας της Έρευνας (Αρ. πρωτ. 90/02.11.2022). Για τη συλλογή και ανάλυση των αποτελεσμάτων του ερωτηματολογίου είναι υποχρεωτική η συμπλήρωση της διεύθυνσης ηλεκτρονικού ταχυδρομείου (email). Οι διευθύνσεις email συλλέγονται και φυλάσσονται μόνον από την Υπεύθυνη Καθηγήτρια Μαρία Καψοκεφάλου και θα χρησιμοποιηθούν μόνον για την ανάλυση των δεδομένων της έρευνας.

1. Καταναλώνετε κρέας ή άλλες πηγές ζωικής πρωτεΐνης (ψάρια, αυγά, γαλακτοκομικά);

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Καταναλώνω συχνά όλες τις ζωικές πηγές πρωτεΐνης- κρέας, όπως μοσχάρι,χοιρινό, κοτόπουλο, γαλοπούλα, ψάρι και/ή οστρακοειδή (Omnivore)
- ◯ Καταναλώνω κρέας μερικές φορές , αλλά προσπαθώ να μειώσω την κατανάλωσή του και συχνά επιλέγω πρωτεΐνες φυτικής προέλευσης (Flexitarian)
- ◯ Καταναλώνω μόνο ψάρια ή/και οστρακοειδή, αλλά όχι άλλα είδη κρέατος (Pescetarian)
- ◯ Καταναλώνω μόνο αυγά ή/και γαλακτοκομικά προϊόντα, αλλά όχι άλλα είδη κρέατος ή ψάρι (Vegetarian)
- ◯ Δεν καταναλώνω ζωικές πηγές πρωτεΐνης -κρέας, ψάρι, αυγά, γαλακτοκομικά προϊόντα ή άλλα ζωικά συστατικά (Vegan)
- ◯ Άλλο: _____

2. Πόσο καιρό ακολουθείτε τις συγκεκριμένες διατροφικές συνήθειες; *

Να επισημαίνεται μόνο μία έλλειψη.

- < 6 μήνες
- 6 μήνες έως 2 έτη
- 2 έως 5 έτη
- > 5 έτη

3. Σε σύγκριση με **ένα χρόνο πριν**, πόσο έχετε αλλάξει την κατανάλωση κρέατος, θαλασσινών, γαλακτοκομικών και αυγού;

(1-Δεν τρώω καθόλου, 4-Τρώω το ίδιο, 7-Τρώω περισσότερο)

Επιλέξτε όλα όσα ισχύουν.

	1	2	3	4	5	6	7
Κρέας (μοσχάρι, χοιρινό, κοτόπουλο, αρνί κ.α.)	☐	☐	☐	☐	☐	☐	☐
Αλλαντικά	☐	☐	☐	☐	☐	☐	☐
Ψάρι	☐	☐	☐	☐	☐	☐	☐
Οστρακοειδή	☐	☐	☐	☐	☐	☐	☐
Γάλα	☐	☐	☐	☐	☐	☐	☐
Τυρί	☐	☐	☐	☐	☐	☐	☐
Γιαούρτι	☐	☐	☐	☐	☐	☐	☐
Αυγά	☐	☐	☐	☐	☐	☐	☐

4. *<u>Ως προϊόν υποκατάστασης εννοείται η απομίμηση του συμβατικού προϊόντος με κύριο συστατικό συνήθως τις φυτικές πηγές πρωτεΐνης</u>

Σε τι βαθμό έχετε σκεφτεί ή θα σκεφτόσασταν να αντικαταστήσετε το κρέας και τα γαλακτοκομικά προϊόντα με νέα προϊόντα βασισμένα σε φυτικές πρωτεΐνες;

(1-Καθόλου, 7-Πολύ)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Έχω σκεφτεί ή θα σκεφτόμουν να αντικαταστήσω το κρέας (μοσχάρι, αρνί, κοτόπουλο, χοιρινό κτλ.) με παραδοσιακές εναλλακτικές πρωτεΐνες (πχ. Όσπρια, μανιτάρια, κ.α.)	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Έχω σκεφτεί ή θα σκεφτόμουν να αντικαταστήσω τα γαλακτοκομικά (γάλα, τυρί, φέτα, γιαούρτη κτλ.) με τα νέα υποκατάστατα που κυκλοφορούν στην αγορά (φυτικής προέλευσης γαλακτοκομικά)	⬭	⬭	⬭	⬭	⬭	⬭	⬭

5. Ποιες πηγές φυτικής πρωτεΐνης προτιμάτε ή θα προτιμούσατε να εντάξετε στη διατροφή σας; (επιλέξτε 1 απάντηση) *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Προτιμώ ή θα προτιμούσα να επιλέγω πηγές φυτικής πρωτεΐνης που βασίζονται στη Μεσογειακή Δίαιτα (πχ. λαχανικά, όσπρια, φρούτα, δημητριακά) μαγειρεμένα με παραδοσιακό τρόπο
- ◯ Προτιμώ ή θα προτιμούσα να επιλέγω μοντέρνες πηγές φυτικής πρωτεΐνης (πχ. απομιμήσεις κρέατος, γαλακτοκομικών, αρτοσκευασμάτων ή/και ζυμαρικών μεβάση τα όσπρια κ.α.)
- ◯ Συνδυασμός των παραπάνω
- ◯ Άλλο: _____

6. Πόσο σκοπεύετε να αλλάξετε την κατανάλωση των παρακάτω τροφίμων τους επόμενους 6 μήνες;Θα τρώτε:

(1- Πολύ λιγότερο, 4-Το ίδιο, 7-Πολύ περισσότερο)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Κρέας (μοσχάρι, χοιρινό, κοτόπουλο, αρνί κ.α.)	◯	◯	◯	◯	◯	◯	◯
Αλλαντικά	◯	◯	◯	◯	◯	◯	◯
Ψάρι	◯	◯	◯	◯	◯	◯	◯
Οστρακοειδή	◯	◯	◯	◯	◯	◯	◯
Γάλα	◯	◯	◯	◯	◯	◯	◯
Τυρί	◯	◯	◯	◯	◯	◯	◯
Γιαούρτι	◯	◯	◯	◯	◯	◯	◯
Αυγά	◯	◯	◯	◯	◯	◯	◯

7. Τι πιστεύετε ότι σας εμποδίζει από το να ακολουθήσετε μια διατροφή που βασίζεται σε πρωτεΐνες φυτικής προέλευσης ; Απαντήστε ναι αν συμφωνείτε, όχι αν διαφωνείτε ή δεν γνωρίζω αν δεν γνωρίζετε σχετικά με τις παρακάτω δηλώσεις.

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	Ναι	Οχι	Δεν γνωρίζω
Δεν θέλω να αλλάξω τις διατροφικές συνήθειες ή τη ρουτίνα μου	◯	◯	◯
Τα τρόφιμα φυτικής προέλευσης δεν είναι αρκετά χορταστικά	◯	◯	◯
Δεν θέλω οι άνθρωποι να πιστεύουν ότι είμαι δύσκολος ή πολύ επιλεκτικός	◯	◯	◯
Πιστεύω ότι ο άνθρωπος από τη φύση του γεννήθηκε για να τρώει κρέας ζωικής προέλευσης (ζωική πρωτεΐνη)	◯	◯	◯
Πιστεύω ότι δεν παίρνω αρκετή ενέργεια ή δύναμη από	◯	◯	◯

τρόφιμα φυτικής προέλευσης			
Τα τρόφιμα φυτικής προέλευσης	⬭	⬭	⬭
δεν είναι αρκετά νόστιμα.			
Θα χρειαστεί να φάω μεγάλη ποσότητα φυτικών τροφών για να αντικαταστήσω την ζωική πρωτεΐνη	⬭	⬭	⬭
Τα τρόφιμα φυτικής προέλευσης φαίνονται πολύ	⬭	⬭	⬭
ασυνήθιστα.			
Δεν υπάρχει αρκετή ποικιλία σε τρόφιμα φυτικής προέλευσης όταν τρώω έξω.	⬭	⬭	⬭
Δεν ξέρω τι επιλογές εναλλακτικών τροφίμων έχω που αντικαταστούν την ζωική	⬭	⬭	⬭
πρωτεΐνη			
Τα τρόφιμα φυτικής προέλευσης	⬭	⬭	⬭

είναι δύσκολο να τα βρεις			
Η οικογένειά μου/ο/η σύντροφός μου δεν τρώει τρόφιμα φυτικής προέλευσης.			
Χρειάζεται πολύς χρόνος για την προετοιμασία γευμάτων φυτικής προέλευσης			
Κάποιος άλλος αποφασίζει για το μεγαλύτερο μέρος του φαγητού που τρώω			
Τα τρόφιμα φυτικής προέλευσης που θέλω να καταναλώσω δεν είναι διαθέσιμα εκεί που ψωνίζω			
Δεν ξέρω πώς να ετοιμάζω γεύματα με βάση τα τρόφιμα φυτικής προέλευσης.			
Δεν υπάρχουν αρκετά θρεπτικά συστατικά στα			

τρόφιμα φυτικής προέλευσης. Δεν υπάρχει αρκετή πρωτεΐνη στα τρόφιμα φυτικής προέλευσης			
Θα ανησυχούσα για την υγεία μου αν έτρωγα αποκλειστικά τρόφιμα φυτικής προέλευσης			
Θα είχα δυσπεψία, φούσκωμα και αέρια αν θα έτρωγα εναλλακτικά τρόφιμα			
Τα τρόφιμα φυτικής προέλευσης είναι πολύ ακριβά			

8. Σε ποιο βαθμό πιστεύετε ότι οι παρακάτω λόγοι επηρέασαν ή θα επηρέαζαν (αν δεν ακολουθείτε μία βιώσιμη διατροφή βασισμένη σε φυτικά τρόφιμα) την απόφαση σας να ακολουθήσετε μια αποκλειστικά βιώσιμη διατροφή βασισμένη σε φυτικά τρόφιμα; *

(1-Πολύ λίγο, 7-Πάρα πολύ)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Ανησυχίες σχετικά με τη σπανιότητα πόρων (π.χ. αυξημένοι πόροι που απαιτούνται για την παραγωγή ζωικών τροφίμων σε σύγκριση με προϊόντα φυτικής προέλευσης)	◯	◯	◯	◯	◯	◯	◯
Υγεία (π.χ. βελτίωση της σωματικής υγείας, διαχείριση χρόνιας νόσου)	◯	◯	◯	◯	◯	◯	◯
Απώλεια βάρους / διαχείριση βάρους	◯	◯	◯	◯	◯	◯	◯
Δεοντολογικά ζητήματα (π.χ. δικαιώματα των ζώων, καλή μεταχείριση των ζώων, ηθικό ζήτημα με την	◯	◯	◯	◯	◯	◯	◯

κατανάλωση ζωικών προϊόντων)							
Αντιπάθεια για ζωικά προϊόντα (π.χ. γεύση, υφή, μυρωδιά κ.λπ.)	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Οικονομικές ανησυχίες (π.χ. κόστος ζωικών προϊόντων έναντι προϊόντων φυτικής προέλευσης)	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Θρησκευτικοί λόγοι	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Πολιτικοί λόγοι (π.χ. παγκόσμια πείνα, δυσανάλογη εξάπλωση του πλούτου)	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Οικογενειακές επιρροές (π.χ. κανονική διατροφή στο σπίτι, συνήθεια μιας συγκεκριμένης διατροφής από την πρώιμη παιδική ηλικία κ.λπ.)	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Κοινωνική							

επιρροή (π.χ. φίλοι που ακολουθούν μια vegan δίαιτα, αύξηση της δημοτικότητας των vegan διατροφών στα μέσα κοινωνικής δικτύωσης κ.λπ.)							
Αυξημένη διαθεσιμότητα φυτικών προϊόντων στα σούπερ μάρκετ (π.χ. μεγάλη ποικιλία και ευκολία στην πρόσβαση)							

9. Έχετε δοκιμάσει υποκατάστατα κρέατος (γύρος, μπιφτέκια, κοτομπουκιές με φυτική πρωτεΐνη κ.α.); *

Να επισημαίνεται μόνο μία έλλειψη.

- Ναι
- Όχι

10. Έχετε δοκιμάσει υποκατάστατα γαλακτοκομικών προϊόντων (Ροφήματα φυτικών καρπών, επιδόρπια γιαουρτιού φυτικών καρπών, φυτικά τυριά κ.α.) ;

Να επισημαίνεται μόνο μία έλλειψη.

- Ναι
- Όχι

11. Πόσο θα καταναλώνετε υποκατάστατα των παρακάτω τροφίμων τους *επόμενους 6 μήνες; (εάν δεν καταναλώνετε υποκατάστατα τροφίμων, απαντήστε το ίδιο).

Θα τρώτε:

(1- Πολύ λιγότερο, 4-Το ίδιο, 7-Πολύ περισσότερο)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Κρέας (μοσχάρι, χοιρινό, κοτόπουλο, αρνί κ.α.)	◯	◯	◯	◯	◯	◯	◯
Αλλαντικά	◯	◯	◯	◯	◯	◯	◯
Ψάρι	◯	◯	◯	◯	◯	◯	◯
Γάλα	◯	◯	◯	◯	◯	◯	◯
Τυρί	◯	◯	◯	◯	◯	◯	◯
Γιαούρτι	◯	◯	◯	◯	◯	◯	◯
Αυγά	◯	◯	◯	◯	◯	◯	◯

12. Ποια θα ήταν **η πρώτη** και **η τελευταία** σας επιλογή αν εντάσσατε στη διατροφή σας πρωτεΐνες εναλλακτικής προέλευσης παραδοσιακές ή μοντέρνες (υποκατάστατα); *

Τοποθετήστε σε σειρά από το 1 (με τη μεγαλύτερη εμπιστοσύνη) έως το 5 (με την μικρότερη εμπιστοσύνη). Επιλέξτε μόνο μία απάντηση ανά στήλη και μία ανά σειρά.

Επιλέξτε όλα όσα ισχύουν.

	1	2	3	4	5
Μύκητες (π.χ. διάφορα είδη μανιταριών, μαγιά)	☐	☐	☐	☐	☐
Πρωτεΐνη με βάση τα έντομα	☐	☐	☐	☐	☐
Πρωτεΐνη με βάση την κυτταροκαλλιέργεια (π.χ. κρέας που έχει αναπτυχθεί στο εργαστήριο)	☐	☐	☐	☐	☐
Πρωτεΐνη φυτικής προέλευσης (συμπεριλαμβανομένων δημητριακών, οσπρίων)	☐	☐	☐	☐	☐
Πρωτεΐνη με βάση τα φύκια	☐	☐	☐	☐	☐

13. Θα αγοράζατε ένα νέο προϊόν που δεν έχετε ξανά δοκιμάσει; (π.χ. ψωμί με πρόσθετα λαχανικά) εάν ισχυρίζεται ότι έχει οφέλη για την υγεία; Επιλέξτε μία απάντηση. *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Ναι
- ◯ Όχι
- ◯ Δεν είμαι σίγουρος/η

14. Πόσο συμφωνείτε με τις παρακάτω δηλώσεις σχετικά με την δοκιμή διάφορων καινούργιων για εσάς τροφίμων;

(1-Διαφωνώ, 7-Συμφωνώ)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Δοκιμάζω συνεχώς νέα και διαφορετικά τρόφιμα	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Δεν εμπιστεύομαι τα νέα	⬭	⬭	⬭	⬭	⬭	⬭	⬭
τρόφιμα							
Αν δεν ξέρω τι περιέχει ένα φαγητό, δεν θα το δοκιμάσω	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Μου αρέσουντα φαγητά από διάφορες	⬭	⬭	⬭	⬭	⬭	⬭	⬭
χώρες							
Οι ethnic κουζίνες και τα φαγητά τους μου φαίνονται πολύ περίεργα για να τα φάω	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Στα δείπνα, δοκιμάζω νέα φαγητά	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Φοβάμαι να φάω πράγματα	⬭	⬭	⬭	⬭	⬭	⬭	⬭

που δεν έχω ξαναφάει							
Είμαι πολύ ιδιαίτερος/η με το φαγητό που θα φάω							
Θα φάω σχεδόν τα πάντα							

15. Ποια από τα παρακάτω θα θέλατε να έχετε ως κύρια συστατικά σε επεξεργασμένα τρόφιμα τα οποία περιέχουν φυτικά συστατικά όπως φυτική πρωτεΐνη; *

Επιλέξτε όλα όσα ισχύουν.

- [ ] Φακές
- [ ] Αμύγδαλα
- [ ] Ρεβύθια
- [ ] Φασόλια
- [ ] Αρακάς
- [ ] Μανιτάρια
- [ ] Βρώμη
- [ ] Φουντούκια
- [ ] Ηλιόσποροι
- [ ] Κάσιους
- [ ] Σπόροι κολοκύθας
- [ ] Σόγια
- [ ] Καρύδα
- [ ] Κινόα
- [ ] Σπόροι κάνναβης
- [ ] Φάβα
- [ ] Σπιρουλίνα
- [ ] Κανένα

16. Θεωρείτε ότι είναι εύκολη η εύρεση των υποκατάστατων κρέατος στα καταστήματα τροφίμων ; *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Ναι
- ◯ Όχι
- ◯ Ίσως

17. Από τα παρακάτω υποκατάστατα κρέατος, ποια είναι αυτά που συναντάτε πιο συχνά στα καταστήματα τροφίμων; **(επιλέξτε έως 3)** *

Επιλέξτε όλα όσα ισχύουν.

- ☐ Φυτικής προέλευσης αλλαντικά *π.χ. Σαλάμι, ζαμπόν φέτες
- ☐ Φυτικής προέλευσης μπιφτέκια
- ☐ Φυτικής προέλευσης κιμάς Φυτικής
- ☐ προέλευσης λουκάνικα
- ☐ Φυτικής προέλευσης κεφτεδάκια κρέατος
- ☐ Φυτικής προέλευσης σνίτσελ/κοτομπουκιές
- ☐ Φυτικής προέλευσης κεμπάπ
- ☐ Φυτικής προέλευσης γύρος
- ☐ Φυτικής προέλευσης ψάρι
- ☐ Φυτικής προέλευσης αβγό
- ☐ Δεν γνωρίζω
- ☐ Άλλο: _____

18. Θεωρείτε ότι είναι εύκολη η πρόσβαση στα υποκατάστατα γαλακτοκομικών προϊόντων; *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Ναι
- ◯ 'Οχι
- ◯ Ίσως

19. Ποια από τα παρακάτω υποκατάστατα γαλακτοκομικών συναντάτε πιο συχνά στα καταστήματα τροφίμων: *

Επιλέξτε όλα όσα ισχύουν.

- [ ] Απομιμήσεις γάλακτος
- [ ] Απομιμήσεις γιαουρτιού
- [ ] Απομιμήσεις παγωτού
- [ ] Απομιμήσεις τυριού

20. Θεωρείτε ότι είναι εύκολη η πρόσβαση σε **ζυμαρικά** εμπλουτισμένα με φυτική πρωτεΐνη (πχ. αλεύρι οσπρίων/αρακά);

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Ναι
- ◯ Όχι
- ◯ Ίσως

21. Θεωρείτε ότι είναι εύκολη η πρόσβαση σε **αρτοσκευάσματα** εμπλουτισμένα με φυτική πρωτεΐνη (πχ αλεύρι οσπρίων/αρακά);

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Ναι
- ◯ Όχι
- ◯ Ίσως

22. Δεδομένου ότι τα υποκατάστατα **τροφίμων** έχουν την ίδια γεύση και υφή με τα αντίστοιχα συμβατικά τρόφιμα. Πόσο πιθανό είναι να **εντάξετε στη διατροφή σας** κάποια από τα παρακάτω τρόφιμα φυτικής προέλευσης αντί για τα συμβατικά τρόφιμα ; *

(1-Απίθανο, 4-Ουδέτερο, 7-Πολύ πιθανό)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Κρέας (μοσχάρι, χοιρινό, κοτόπουλο, αρνί κ.α.)	◯	◯	◯	◯	◯	◯	◯
Αλλαντικά	◯	◯	◯	◯	◯	◯	◯
Ψάρι	◯	◯	◯	◯	◯	◯	◯
Γάλα	◯	◯	◯	◯	◯	◯	◯
Τυρί	◯	◯	◯	◯	◯	◯	◯
Γιαούρτι	◯	◯	◯	◯	◯	◯	◯
Αυγά	◯	◯	◯	◯	◯	◯	◯

23. Πόσο πιθανό είναι να **πληρώσετε** υψηλότερη τιμή για κάποια από τα παρακάτω τρόφιμα φυτικής προέλευσης αντί για τα συμβατικά τρόφιμα; *

(1-Απίθανο, 4-Ουδέτερο, 7-Πολύ πιθανό)

Να επισημαίνεται μόνο μία έλλειψη ανά σειρά.

	1	2	3	4	5	6	7
Κρέας (μοσχάρι, χοιρινό, κοτόπουλο, αρνί κ.α.)	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Αλλαντικά	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Ψάρι	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Γάλα	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Τυρί	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Γιαούρτι	⬭	⬭	⬭	⬭	⬭	⬭	⬭
Αυγά	⬭	⬭	⬭	⬭	⬭	⬭	⬭

24. Πόσο πιθανό είναι να αγοράσετε για να δοκιμάσετε **εμπλουτισμένα προϊόντα αρτοποιίας** με φυτική πρωτεΐνη; *

Να επισημαίνεται μόνο μία έλλειψη.

	Απίθανο
1	◯
2	◯
3	◯
4	◯
5	◯
6	◯
7	◯
	Πολύ πιθανό

25. Πόσο πιθανό είναι να αγοράζατε για να δοκιμάσετε **εμπλουτισμένα προϊόντα ζυμαρικών** με φυτική πρωτεΐνη *

Να επισημαίνεται μόνο μία έλλειψη.

	Απίθανο
1	◯
2	◯
3	◯
4	◯
5	◯
6	◯
7	◯
	Πολύ πιθανό

26. Δεδομένου ότι τα προϊόντα **αρτοποιίας** (π.χ. ψωμί ή μπισκότα χωρίς αυγά ή βούτυρο) και **ζυμαρικά** έχουν ακριβώς την ίδια γεύση και υφή με τα συμβατικά προϊόντα αρτοποιίας. Πόσο πιθανό είναι να **εντάξετε** στη διατροφή σας υποκατάστατα προϊόντων αρτοποιίας και ζυμαρικών αντί για συμβατικά προϊόντα αρτοποιίας; *

Να επισημαίνεται μόνο μία έλλειψη.

	Απίθανο
1	◯
2	◯
3	◯
4	◯
5	◯
6	◯
7	◯
	Πολύ πιθανό

27. Πόσο πιθανό είναι να πληρώσετε υψηλότερη τιμή για τα **εμπλουτισμένα προϊόντα αρτοποιίας** από ό,τι για τα συμβατικά αρτοσκευάσματα;

Να επισημαίνεται μόνο μία έλλειψη.

	Απίθανο
1	◯
2	◯
3	◯
4	◯
5	◯
6	◯
7	◯
	Πολύ πιθανό

28. Πόσο πιθανό είναι να πληρώσετε υψηλότερη τιμή για τα **εμπλουτισμένα προϊόντα ζυμαρικών** από ό,τι για τα συμβατικά ζυμαρικά; *

Να επισημαίνεται μόνο μία έλλειψη.

	Απίθανο
1	◯
2	◯
3	◯
4	◯
5	◯
6	◯
7	◯
	Πολύ πιθανό

Δημογραφικά στοιχεία

29. Ηλικία *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ 18-29
- ◯ 30-39
- ◯ 40-49
- ◯ 50-59
- ◯ 60-69
- ◯ 70+

30. Ποιο από αυτά περιγράφει καλύτερα τον τόπο διαμονής σας; *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Αστικό κέντρο (>750000 κατοίκους)
- ◯ Ημιαστικό κέντρο (<750000 κατοίκους)
- ◯ Αγροτική - έξω από μια πόλη π.χ. χωριό / εξοχή / περιοχή καλλιέργειας

31. Ποια είναι η υψηλότερη βαθμίδα εκπαίδευσης που έχετε ολοκληρώσει;

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Απόφοιτος δημοτικού
- ◯ Απόφοιτος γυμνασίου
- ◯ Απόφοιτος λυκείου
- ◯ Πτυχίο Ι.Ε.Κ/Δ.Ι.Ε.Κ
- ◯ Πτυχίο Πανεπιστημίου Α.Ε.Ι/ Τ.Ε.Ι
- ◯ Μεταπτυχιακό
- ◯ Διδακτορικό

32. Ποια είναι η δεδομένη επαγγελματική σας κατάσταση; *

Να επισημαίνεται μόνο μία έλλειψη.

- ◯ Εργαζόμενος
- ◯ Άνεργος
- ◯ Συνταξιούχος
- ◯ Φοιτητής

33. Το νοικοκυριό σας αποτελείται από : *

Να επισημαίνεται μόνο μία έλλειψη.

- 1 άτομο
- 2 άτομα
- 3 άτομα
- 4 άτομα
- 4+ άτομα

34. Ακολουθεί κάποιο άτομο από το νοικοκυριό σας φυτική διατροφή; *

Να επισημαίνεται μόνο μία έλλειψη.

- Ναι
- Όχι

35. Ποιο είναι το ετήσιο εισόδημα σας ή του νοικοκυριού σας σε ευρώ; *

Να επισημαίνεται μόνο μία έλλειψη.

- έως 6000€
- από 6000€ έως 12000€
- από 12000€ έως 24000€
- από 24000€ έως 50000€
- πάνω από 50000€
- δεν γνωρίζω

Με την υποβολή του ερωτηματολογίου συναινείτε στον γενικό Κανονισμό που αφορά την ασφάλεια των προσωπικών σας δεδομένων - GDPR - Γενικός κανονισμός για την προστασία δεδομένων (GDPR EU 2016/679). Τα στοιχεία και οι απαντήσεις σας θα καταγραφούν μόνο για εύλογο χρονικό διάστημα που αφορά την ακαδημαϊκή έρευνα και τις στατικές αναλύσεις της διπλωματικής μελέτης και έπειτα θα διαγραφούν.