

Protein Consumption Patterns of Plant-Based and Meat-Based Consumers in the Netherlands

Author: Savan Heijnen

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Coach: Umair Qureshi

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Preface

My name is Savan Heijnen, I am a fourth-year student at Aeres University of Applied Sciences in Dronten and Dalhousie University Faculty of Agriculture in Nova Scotia, Canada. I am concluding my study International Food Business with a thesis report.

This thesis could be used by consumers who are wanting to switch to a plant-based diet. Additionally, this research could be used by businesses to figure out what aspects or foods are important to consumers.

Food Mission devises and organizes programs and events that activate and inspire people to eat more plant-based food. It is an own initiative, but also executed on behalf of companies and government agencies. Food Mission will use this thesis to spread information about plant-based diets.

I want to thank my fellow classmates, for helping me understand the process, as well as being available for information and debates. I want to thank my family, for supporting me through the process and providing extra motivation when needed.

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Summary

Climate change is becoming an increasingly important topic and issue worldwide. To change what is currently happening, adjustments within society need to be made. Plant-based diets have a smaller ecological footprint compared to other diets, such as a meat-based diet. In addition, research shows that a plant-based diet has several health benefits. When following a plant-based diet a proper nutrient intake is crucial. This research aims to identify the protein consumption patterns of plant-based and meat-based consumers in the Netherlands. This research can help Dutch businesses formulate market entry strategies as well as marketing strategies. In addition, it can help consumers inform themselves about different diets. Governmental organizations can also use the information given in this research to inform/activate the Dutch population about following a plant-based diet and the protein intake of this diet.

The main question of this research is *What are the differences in protein consumption patterns between Dutch meat-based and plant-based consumers?* This question was answered by important findings regarding the estimated protein intake of Dutch plant-based and meat-based consumers. As well as data regarding the main plant-protein source for Dutch consumers and the importance of protein intake for Dutch consumers.

Data was collected by means of a survey. The target group of this survey was plant-based or meat-based consumers between the age of 18 and 75 who are currently living in the Netherlands. The survey was shared on social media platforms. 155 consumers answered the questionnaire, of which 88 were plant-based and 67 were meat-based consumers.

This research found that the estimated protein intake of Dutch plant-based consumers is lower compared to Dutch meat-based consumers. The main plant-protein source for plant-based consumers was found to be legumes, however, the main plant-protein source for meat-based consumers was found to be cereals. Both groups of consumers think it is equally as important to consume sufficient protein.

The main recommendation is for businesses who want to enter the legumes market, to put a focus on the protein content of the products, and to highlight this fact in the marketing strategies. In addition, it is recommended for consumers who want to follow a plant-based diet to be well informed about a proper nutrient intake, in addition to tracking the food intake in the beginning phase to discover any insufficient nutrient intake, including protein intake.

1. Introduction

The focus of this research paper involves the intake of protein among vegans as well as omnivores in the Netherlands.

1.1 Plant-Based Diet

Veganism is a philosophy and lifestyle form in which no animal products are used. Meaning, no leather shoes or belts and no wool coat (Vegan Society, 2021). Vegans follow a plant-based diet. A plant-based diet consists of all foods excluding all animal products including red meat, poultry, fish, eggs, and dairy products (Ostfeld, 2017).

When following a plant-based diet, it is likely that more fruits and vegetables are consumed daily (Davey et al., 2013). According to several studies, a plant-based diet is richer in antioxidants, vitamin A, C and E and magnesium compared to a meat-based diet (Davey et al., 2003). A plant-based diet has also been proven to lower blood sugar levels resulting in a lower risk of developing diabetes type 2 (Dinu et al., 2017). Studies have been done on the link between a plant-based diet and cancer. According to multiple studies, a plant-based diet might reduce the risks of prostate, breast, and colon cancer (Oyebode et al., 2014). There are many more health benefits when incorporating a plant-based diet (Petre, 2016). However, not all vegan diets are healthy. Having a plant-based diet and eating mainly wholefood is healthy. Although, a plant-based diet could technically also be fries and a vegan burger, this is of course not healthy (Petre, 2016).

A plant-based diet means that not all foods are consumed, meaning, not all nutrients and vitamins needed are present in the diet. When following a plant-based diet, vitamin B12 and omega 3 needs to be supplemented (Donaldson, 2000). It is possible to consume all vitamins and nutrients when following a plant-based diet. However, it is more difficult to have a sufficient intake of iron, calcium, omega 3, vitamin A and vitamin D (Zimmer & Webb, 2021). In addition, when consuming plant-protein sources, limited number of amino-acids are present and consumed (Rogerson, 2017). Therefore, it is important to consume different types of plant-based protein sources to make sure all essential amino acids are consumed (Rogerson, 2017). The Academy of Nutrition and Dietetics recommends consuming a range of different plant-based protein sources to make sure all essential amino acids are present in the diet (Rogerson, 2017).

1.2 Climate and Environment in Relation to Food System

The European Union has set several goals for the upcoming years regarding greenhouse gas emissions and the overall climate change. The goal for 2030 is to reduce the greenhouse gas emissions by at least 40% (Ministerie van Algemene Zaken, 2020). To reach these goals, change is needed. 26% of global greenhouse gas emissions is coming from food production (Ritchie, 2019). Of that 26%, 53% is for livestock and fisheries (31%), crops for animal feed (6%) and for land use for livestock (16%) (Ritchie, 2019). Animal based diets are responsible for 13,78% of the greenhouse gas emissions worldwide (Ritchie, 2019). To get the greenhouse emissions down, a transition in the food system is needed. A plant-based diet can play an important role in changing our food system towards a more environmentally friendly system.

A study by Oxford University quotes “avoiding meat and dairy products is the single biggest way to reduce the environmental impact on the planet” (Poore & Nemeck, 2018). The global use of water and land is increasing daily (Poore & Nemeck, 2018). The increasingly high amount of food consumption results in the demand of more resources. However, this is not always the case. The study by Oxford University shows that the use of farmland around the world could be reduced by 75% if meat and dairy is cut out from diets (Poore & Nemeck, 2018). Currently, over 80% of land is used for livestock (Poore & Nemeck, 2018). By participating in a plant-based diet, a reduction in the environmental footprint is likely to be seen. Additionally, the land and water usage per person is significantly smaller compared to a meat-based diet (Poore & Nemeck, 2018). Another study shows that the footprint of a vegan consumer is over twice as small as the footprint of a person who eats meat (Wilson, 2021)

1.3 Vegan Trend

According to a 2018 press release from the RLI (Council for the Environment and Infrastructure), “a sustainable diet contains much less animal protein and more plant protein”. The Dutch government has set a goal to reduce the consumption of animal protein by at least 20% in 2030 (RLI, 2018).

According to data from IRI Nederland, the number of vegan meat substitute products in supermarkets within the Netherlands has increased by 51% since 2017 (Webber, 2020). This increase is happening while the meat sales decreased by 9% (Webber, 2020). This data shows that there is a transition happening within the Dutch food systems. The transition theory is described in the book ‘Food Practices in Transition’ by Gert Spaargaren, Peter Oosterveer and Anne Loeber, shown in figure 1 (Spaargaren et al., 2013). The socio-technical landscape is expressing pressure on the socio-technical regime. For example, the climate change issue is expressing pressure on the current society. The niche innovations introduce new ideas to the socio-technical regime that have been catalysed by the socio-technical landscape. New developments are introduced by the group who invents and develops the niche innovations. These niche innovations are for example, vegan meat replacers. These vegan meat replacers have a smaller environmental footprint than actual meat has. These niche innovations are slowly

introduced to the socio-technical regime and therefore changing the society. This change is introducing awareness about a plant-based diet.

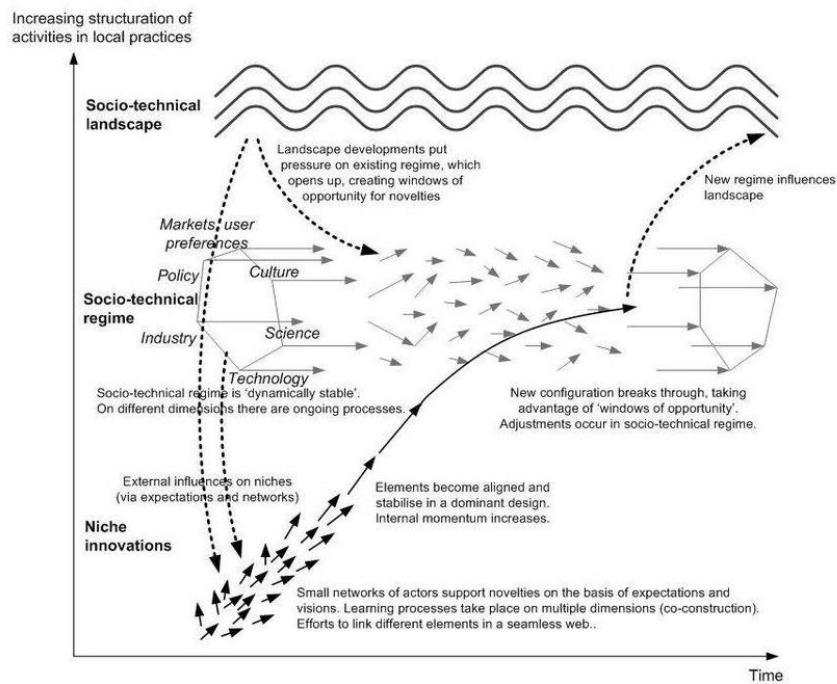


FIGURE 1: TRANSITION THEORY

A lot of businesses are aware of this vegan trend and are therefore acting accordingly. Burger King recently came out with a vegan line of burgers and nuggets in collaboration with the Vegetarische Slager (EVMI, 2021). These products are available at all stores in the Netherlands. According to a press release, Burger King is filling the need created by guests “so plant-based can grow into a full category within the menu of the chain” (EVMI, 2020). Burger King’s strategy is to create sustainable options, which is a strategy that could also be implemented by other big or small companies (EVMI, 2021). The plant-based options at Burger King were introduced on the 11th of May 2021 (EVMI, 2021). Because of the recent addition, no sales data is publicly available yet.

1.4 Protein

Protein is an essential macro nutrient for the human body. Protein is present in every cell in the human body. Protein is made from more than twenty amino acids. Nine amino acids are essential and must be derived from foods. The remaining amino acids can be derived from other modified amino acids (Harvard, 2021). According to the Dutch standards, a healthy person needs 0,83 grams of protein per kilogram body weight per day (Voedingscentrum, 2021). Meaning that someone who weights 80 kilograms needs 66,4 grams of protein daily. Athletes who want to increase muscle mass, often need a higher protein intake (Voedingscentrum, 2021). Too much protein results in an abundance of energy which results in fat storage (Voedingscentrum, 2021).

In a meat-based diet, the main source of protein is meat. Other sources are eggs, milk, seafood, and cheese (Betterhealth, 2020). These protein sources are not present in a plant-based diet. Therefore, a lot of protein sources are eliminated for vegans. However, a lot of other foods contain good amounts of protein. Protein sources in a plant-based diets are legumes, beans, nuts, seeds, tofu, and meat alternatives (Betterhealth, 2020).

Protein deficiency refers mostly to an absence of (essential) amino acid(s) (Bhutta & Sadiq, 2013). In case of the presents of protein deficiency, the protein turnover is low. Meaning, that broken amino acids cannot be replaced by new amino acids, resulting in amino acid catabolism. This proceeds to result in the breakdown of lean tissue in the human body (Bhutta & Sadiq, 2013). Lean tissue refers to everything in the human body exempting body fat (Bowerman, 2017).

A high protein intake is often present in a diet for people who want to gain muscle mass. However, research shows that a high protein diet (4.4 g/kg/day) does not have any effects on the body composition of resistance-trained individuals compared to a normal diet in terms of protein intake (Antonio et al., 2014). An excess amount of protein that cannot be used by the body will be stored in the form of fat. On top of this, a protein surplus has several health effects. A high protein diet is often associated with increased hart problems, cancer, or cholesterol problems (Delimaris, 2013).

In addition to athletes, it is also recommended for elderly to consume more protein (Deer & Volpi, 2015). To maintain the function of the muscles and skeletal muscles, a sufficient protein intake is needed. Research showed that an increased protein intake is needed for elderly to maintain good health and functionality (Deer & Volpi, 2015).

Nearly all Dutch consumers have a sufficient protein intake, according to a research published by Voedingscentrum. 68% of the protein intake from Dutch consumers is animal protein (van Dooren & Seves, 2018). According to a paper published by Voedingscentrum regarding The Wheel of Five Guidelines tool used by the Netherlands Nutrition Centre, the recommendation is to eat 50% animal protein and 50% plant protein (Brink et al., 2017). These recommendations are not met according to the data from Voedingscentrum. In this research, the Dutch Health

Counsel stated that when following a diet in which plant-protein is 100% of the protein intake, additional protein should be consumed, such as protein powders, shakes and bars (Van Dooren & Seves, 2018).

There is no existing data on the protein intake among Dutch vegans. Data about the protein intake among vegans has been collected in Sweden and Denmark. In addition, data from a Danish research indicates facilitators and barriers towards adopting a more plant-based diet.

In a research published by The American Journal of Clinical Nutrition, the dietary intake of adolescent vegans was compared to the dietary intake of omnivores in Sweden (Larsson & Johansson, 2002). In this research, the dietary intake was measured by taking blood samples and urine samples. The results showed a lower protein intake among younger vegans in comparison with the protein intake of omnivores (Larsson & Johansson, 2002). However, the research also showed that the protein intake of Swedish vegans is still above the recommended amount of protein they should consume (Larsson & Johansson, 2002).

In a research published by the Nutrition Journal, a comparison in macro- and micronutrient intake was done among Danish vegans and DANSDA (Kristensen et al., 2015). DANSDA is the general population from the Danish National Survey of Dietary Habits and Physical Activity (Kristensen et al., 2015). In this research, participants had to track a 4-day food intake, from which a calculation was made to determine the macro- and micronutrient intake. The protein intake was included in this list. Concluded from the protein intake in this research, was that the Danish vegans on average have a lower protein intake compared to the general population (Kristensen et al., 2015).

The University of Copenhagen in cooperation with other entities conducted a research about the barriers and facilitators towards adopting a more plant-based diet among Danish consumers (Reipurth et al., 2019). This research showed a negative attitude about protein content of plant-based diets for the consumers with a high meat or all animal products intake (Reipurth et al., 2019). On the contrary, the segment with a low animal product intake, considered the protein content as a facilitator towards adopting a more plant-based diet (Reipurth et al., 2019).

1.5 Protein Consumption among Dutch Consumers

As previously stated, veganism and plant-based consumption is a rising trend in the Netherlands. Plant-based consumption is rising currently among the Dutch consumers (Webber, 2020). Resulting in a bigger target market for plant-based products among Dutch consumers. The topic 'plant-based protein sources' is increasingly relevant. The consumption of plant-based meat alternatives has been growing for 4 years (Webber, 2020). Businesses sell more plant-based meat alternatives and therefore new opportunities are opening within the plant-based food market. Using the right strategies and knowing what products to introduce to the market is crucial for businesses. In addition, in a research published by Voedingscentrum, the Council for the Environment and Infrastructure recommends 60% plant protein intake and 40% animal protein intake by 2020 (van Dooren & Seves, 2018). As mentioned previously, the Netherlands consumes an average of 61% animal protein and 39% plant protein (van Dooren & Seves, 2018). Adjustments in the diets of Dutch consumers is needed to reach the recommendations of the Council for the Environment and Infrastructure.

The protein intake in a plant-based diet compared to a meat-based diet among Dutch consumers is unknown. Therefore, this will be new information that could be helpful for Dutch consumers as well as Dutch businesses. The difference in protein consumption patterns between meat-based and plant-based consumers will be presented. Knowing what products are important to plant-based consumers is interesting for businesses in the Netherlands.

In addition to the estimated protein intake of plant-based and meat-based consumers, the importance of protein intake for Dutch consumers is also asked. The importance of protein intake for both groups of consumers can be linked to the business strategies potentially used by businesses. If the protein content of a meat substitute is important to Dutch consumers, this should be included in the strategies of the businesses who operate within the plant-based product market. The most important protein source for omnivores should also be included in the strategies of business who operate in the meat-based product market.

The research question and sub-questions for this research have been formulated as follows.

What are the differences in protein consumption patterns between Dutch meat-based and plant-based consumers?

The sub questions for this research are:

1. What is the estimated protein intake based on the main protein sources for Dutch plant-based consumers?
2. What is the estimated protein intake based on the main protein sources for Dutch meat-based consumers?
3. What are the most frequently consumed plant protein sources for Dutch plant-based and meat-based consumers?
4. How important is protein intake for plant-based and meat-based consumers in the Netherlands?

The general objective of this research is to identify and analyse the protein consumption patterns of Dutch meat-based and plant-based consumers. This includes the importance of protein intake, the estimated protein intake, and the main protein sources for plant-based and meat-based consumers in the Netherlands. The estimated protein intake will be based on the main protein sources of both diets. The products identified as the frequently consumed plant/animal protein sources, can be promoted by using the information supplied by this research. By using the right marketing tools and techniques for these products, the sales could be increased. In addition, it can help businesses to understand the Dutch market and help decide which products to launch in 2022. On top of the use of this information for businesses, consumers could also use the identified main protein sources as inspiration or information about different diets. In addition, the data collected in this research could also be used by governmental organizations. Recommendations will be made for businesses to effectively use information provided by this research.

2. Methodology

In this chapter, the materials and methods used for this research will be given and described.

2.1 Materials and Methods

The aim of this research is to identify and analyse the estimated protein intake of Dutch plant-based and meat-based consumers. In addition, the most frequently consumed plant-protein source as well as the importance of protein intake for both groups of consumers, can help businesses understand the Dutch market. The estimated protein intake will be based on the main protein sources of both diets and calculated per participant. Consequently, the estimated protein intake from plant-based consumers will be compared to the estimated protein intake of meat-based consumers. This research will be conducted by collecting data from the target group. The target group are plant-based and meat-based consumers who are currently living in the Netherlands. Dutch consumers are the focus because of the shown transitions within the Dutch food system towards a more sustainable diet. Most of the respondents are likely to be between the age of 18 and 75.

The data will be collected by means of a survey. The questionnaire is divided into sections. Each section is designated to answer a sub-question. The survey is online and has been developed in Google Forms. Therefore, there are no limitations in number of respondents or other useable additional tools.

The questionnaire will be shared among Dutch meat-based and plant-based consumers, via different platforms. Using different platforms will most likely lead to a diverse set of respondents. The questionnaire will be shared on Facebook, Instagram, and LinkedIn. Facebook offers a diverse set of groups, which each attract a certain type of person. For example, the questionnaire will be shared in the 'Vegan Nederland' group to gather data from Dutch plant-based consumers. The questionnaire is given in appendix A. The questionnaire is given in English; however, it will be shared in Dutch because only Dutch consumers are included in the target group.

To conduct a reliable research, a sample size of respondents will be calculated. The respondents must be plant-based or meat-based and must be living in the Netherlands. According to the most recent research, an estimated 1% of the Dutch population is plant-based which results in a plant-based population of 172,800 people (NU.nl, 2019). In addition, an estimated 50% of the Dutch population still consumes meat on a regular basis, resulting in a meat-based population of 8,812,800 people (Kien, 2018). The total sample population is 8,985,600.

The sample size is calculated by using the formula given in figure 2. The variables for this formula are as follows, z = z-score, p =standard deviation, e = margin of error and N = population size. The confidence level is set at 95% which results in a z-score of 1,96. The margin of error is

set at 8%. To avoid error, the formula was calculated by an automatic calculation from SurveyMonkey (SurveyMonkey, 2021).

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N} \right)}$$

FIGURE 2: SAMPLE SIZE FORMULA

The minimum sample size for this research is 151 respondents.

2.2 Survey

The questionnaire is given in Appendix A. The questionnaire exists of 32 questions, which are all closed questions. The questionnaire is divided into 4 sections.

The first section, existing of two questions, is orientation. In this section, participants who are not included in the target group are eliminated. The first question asks what diet they follow, in which only plant-based and meat-based are the options. When selecting the 'other' option, the participant is not included in the target group and therefore the questionnaire is automatically submitted. The second question asks to what nationality the participant belongs. This question eliminates participants who are not Dutch. Again, when selecting the 'other' option, the questionnaire is automatically submitted. The first two questions eliminate respondents who are not part of the target group.

The second section is statements. Four different statements are given to which the respondents must indicate whether they agree or not. Four different options are given; strongly disagree, disagree, agree, and strongly agree. By using a four-point Likert scale, a clear opinion is formed by the respondents. The option 'neither disagree nor agree' leaves space for the respondent to avoid answering the question. Therefore, the four-point Likert scale was used instead of five-point or seven-point scale.

The third section is food groups. In this section, ten different foods are given to which the respondent must indicate the average amount of portions they eat of that certain food per week. The portion sizes are given in table 1. The different food groups are meat, fish and shellfish, dairy and eggs, plant-based dairy, cereals, nuts and seeds, legumes, meat substitutes and protein-rich products (Ocke, 1997). For every food group, a list of examples is given in the questionnaire. The examples are provided to help the respondents fill in a realistic answer.

The fourth and final section is general information. Information like gender, age, education level and household are asked. This will help dividing the target groups into further subgroups, as well as provide any extra information needed.

The protein content of every food group has been indicated in table 2. The protein content for each food group has been calculated by adding the protein content of every food given as examples of the food group in the questionnaire and dividing that number by the number of foods given as examples of the food group in the questionnaire. By using an average of all products that belong to the certain food group, an estimated protein intake is calculated.

TABLE 1: PORTION SIZE PER FOOD GROUP (VOEDINGSWAARDETABLE, 2021)

Food group	Average portion size
Meat	125g
Fish and shellfish	100g
Dairy	200g
Eggs	60g
Plant-based dairy	200g

Cereals	75g
Nuts and seeds	20g
Legumes	150g
Meat substitutes	75g
Protein-rich products	25g

TABLE 2: PROTEIN CONTENT PER FOOD GROUP (USDA, 2021)

<u>Food group</u>	<u>Average protein content per 100g</u>	<u>Average protein content per portion</u>
Meat	26.8g	33.5g
Fish and shellfish	20.9g	20.9g
Dairy	11.4g	22.8g
Eggs	13.0g	7.8g
Plant-based dairy	3.5g	7g
Cereals	8.3g	6.23g
Nuts and seeds	18.2g	3.64g
Legumes	13.2g	19.8g
Meat substitutes	23.5g	17.63g
Protein-rich products	80g	20g

Every sub question will be answered to formulate an answer to the main question.

The first sub question is “What is the estimated protein intake based on the main protein sources for Dutch plant-based consumers?”. This question is answered by plant-based consumers who answer question 15 up to and including question 26. In these questions the plant-based consumers indicate the number of portions of protein sources they consume on average per week. Based on the number of portions consumed weekly, an estimated protein intake is calculated. The data of protein per portion used for these calculations is given in table 2.

The second sub question is “What is the estimated protein intake based on the main protein sources for Dutch meat-based consumers?”. This question is answered by meat-based consumers who answer question 7 up to and including question 26. In these questions the meat-based consumers indicate the number of portions of protein sources they consume on average per week. The same calculations (sub question 1) will be used including data from table 2.

The third sub question is “What are the most frequently consumed plant-protein sources for Dutch plant-based consumers?”. This question is answered by looking at the answers given by plant-based consumers in question 15 up to and including 26. The total amount of protein per food group will be calculated by using data from table 2, to identify the main protein sources for plant-based consumers. Identifying the main plant-protein sources could help businesses in the Dutch plant-based market.

The fourth and final sub question is “How important is protein intake for plant-based consumers in the Netherlands?”. This sub question is answered by plant-based consumers in question 3, 4,5 and 6. In these questions, the respondents must give an opinion on statements given. The statements ask opinions on protein intake. The first statement asks the participants opinion on protein intake when not consuming meat. The second statement asks about the opinion of participants on the daily protein intake. The third statement asks about the importance of a sufficient protein intake. The fourth and final statement asks whether the participants eat certain food more for a sufficient protein intake. Based on the answers, a conclusion can be drawn about the importance of protein intake among plant-based consumers.

The data collected has been entered into MS Excel and a comparison test has been executed on the data regarding the estimated protein intake of Dutch plant-based and meat-based consumers. The data was sorted into a pivot table to create a clear and structured overview of the data collected. In addition, the estimated protein content per participant has been calculated using MS Excel. A T-test showed whether there was a significant difference between the average protein consumption of plant-based and meat-based consumers. Because there are two sample groups, plant-based consumers, and meat-based consumers, with only variable measured, an independent T-test has been used.

Furthermore, the data has been categorized using ordinal scaling methods. The ordinal scaling method indicates the ranking and ordering of quantitative data. By using the ordinal scaling method, it was easier to compare data.

3. Results

To collect data, a survey was distributed among the target group. Based on the responses, the four sub-questions and ultimately the main question can be answered. The questionnaire was answered by 155 respondents. All the respondents are part of the target group. Therefore, all answers are used. Of the 155 respondents, 119 identified as female and 34 identified as male. 1 respondent identified as 'different', and 1 respondent would rather not share their gender. The age distribution is presented in figure 3.

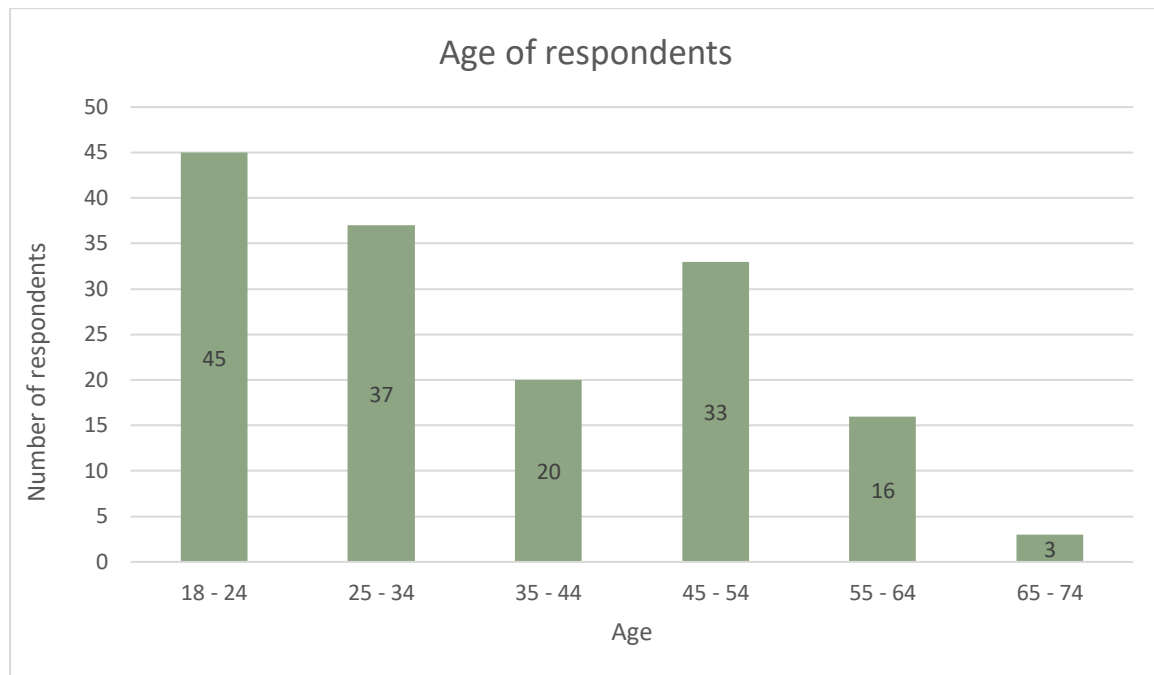


FIGURE 3: AGE DISTRIBUTION

Of the 155 respondents, 1 respondent selected the 'rather not say' option for this question. Most of the respondents, 29%, are between 18 and 24 years old. The second largest group of respondents, 24%, are between the 25 and 34-year-old age range. 13% are between 35 and 44 years old. The third biggest group of respondents, 21%, are between 45 and 54 years old. 10% are between 55 and 64 years old and 2% of the respondents are between 65 and 74 years old.

There are two groups of respondents, Dutch plant-based consumers, and Dutch meat-based consumers. This data is presented in figure 4, given in frequencies.

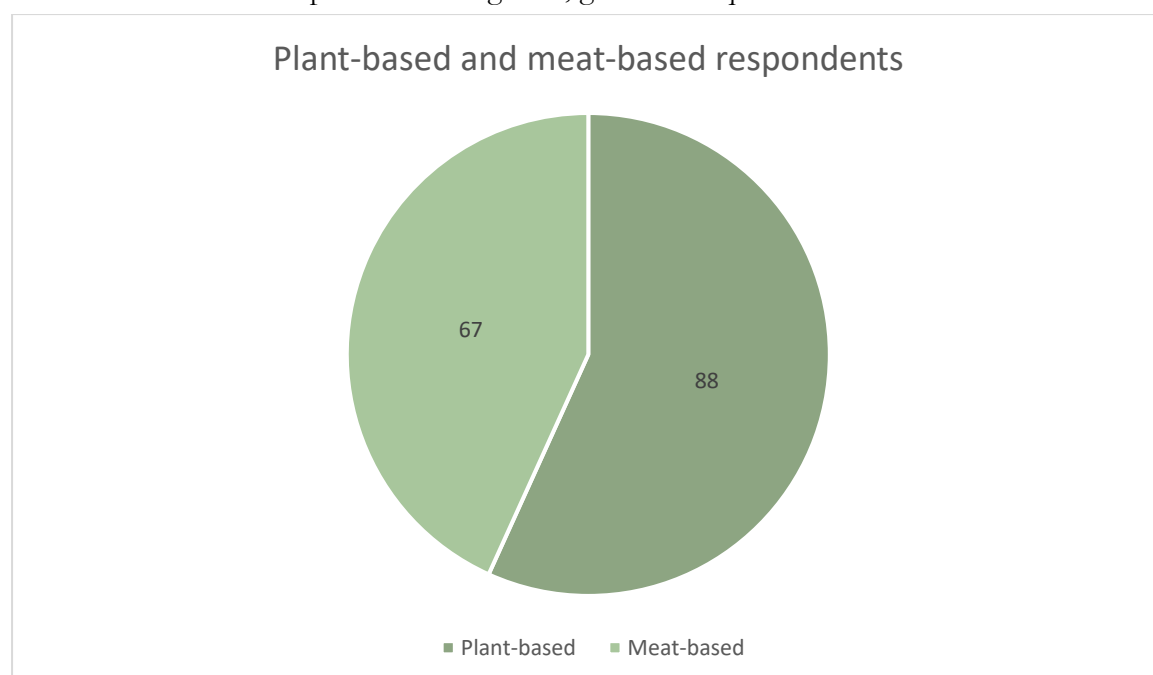


FIGURE 4: PLANT-BASED AND MEAT-BASED CONSUMER DISTRIBUTION

Of the 155 respondents, 57% identified as a plant-based consumer and 43% identified as a meat-based consumer.

The respondents had to indicate their education level. Out of the 155 respondents, 3 selected the ‘rather not say’ option for this question and are therefore not included. In addition, none of the respondents indicated ‘primary school’ as education level, therefore this option is also not included. The data collected regarding the education level is given in table 3 below.

TABLE 3: EDUCATION LEVEL OF RESPONDENTS PER CONSUMER GROUP

	High school		MBO		HBO or WO bachelor		Master or PhD		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%
Plant-based	10	67%	15	56%	46	55%	15	58%	86	57%
Meat-based	5	33%	12	44%	38	45%	11	42%	66	43%
Total	15	100%	27	100%	84	100%	26	100%	152	100%

Most of the respondents indicated to have an HBO or WO bachelor education level (55%). 18% of the respondents have a MBO education level and 17% have a Master or PhD education level. A minority of 10% have a high school education.

3.1 Statements

Four statements have each been answered by all 155 respondents using a 4-point Likert scale. The answer options are 'strongly agree', 'agree', 'disagree', and 'strongly disagree'. The first statement is as follows, 'If you do not consume meat, you will eat enough protein'. The second statement is, 'I get enough protein in one day from my diet'. Thirdly, 'I think it is important to get enough protein from my diet'. The fourth and final statement is, 'I eat more of certain foods to make sure I consume enough protein'.

Figure 5 presents the answers given to the first statement, 'If you do not consume meat, you will eat enough protein'. The data is given in frequency of the options chosen.

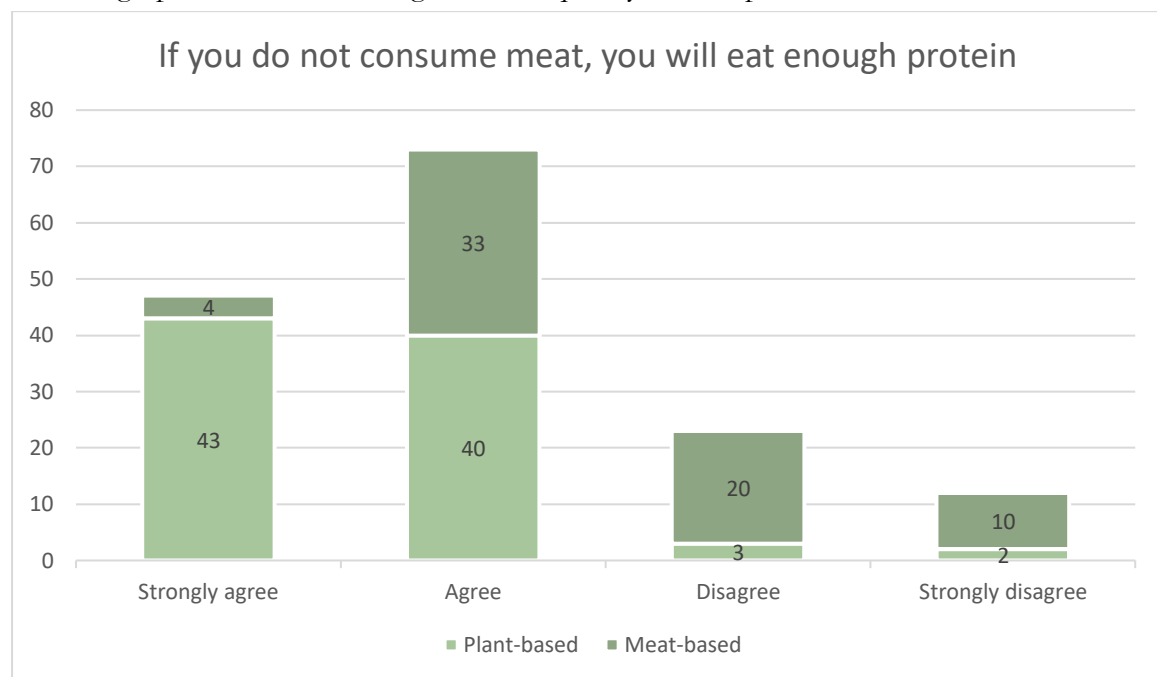


FIGURE 5: OPINIONS ON PROTEIN CONSUMPTION WHEN FOLLOWING A PLANT-BASED DIET

Most of the respondents, 47%, agree with the statement. 30% strongly agree with the statement. A minority of 15% disagrees and 8% strongly disagrees.

Figure 6 below shows the answers given to the second statement, 'I get enough protein in one day from my diet'. The data is given in frequency of the options chosen.

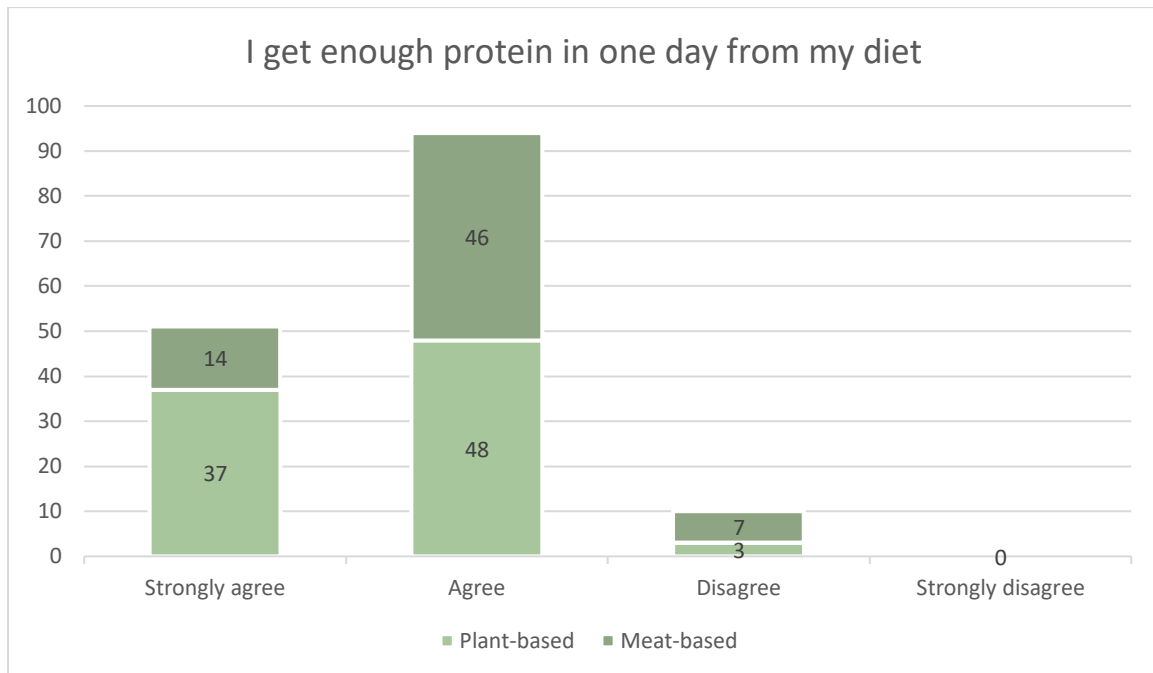


FIGURE 6: OPINIONS ON PERSONAL PROTEIN INTAKE

Most of the respondents, 61%, agree with the second statement. 33% of the respondents strongly agree with the statement. Only 6% disagrees with the statement and none of the respondents strongly disagree.

Figure 7 below shows the answers given to the third statement, 'I think it is important to get enough protein from my diet'. The data is given in frequency of the options chosen.

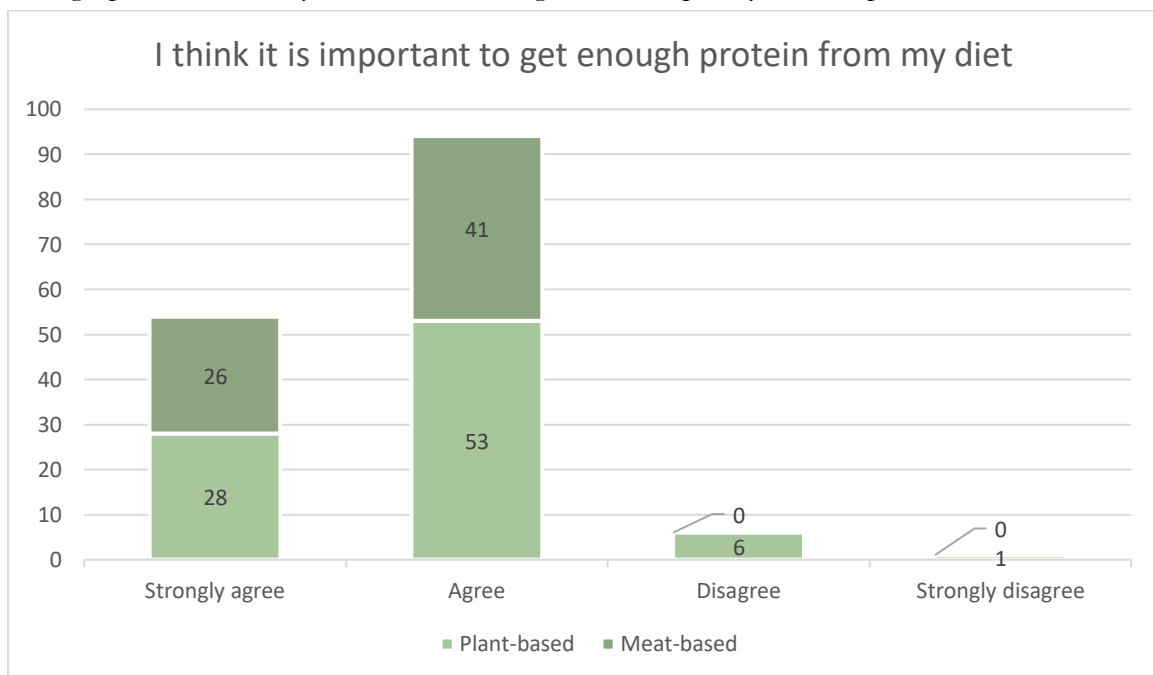


FIGURE 7: OPINIONS ON IMPORTANCE OF PROTEIN INTAKE

Most of the respondents, 61%, agrees with the statement. 35% of the respondents strongly agrees with the statement. A minority of 4% disagrees and only 0,6% strongly disagrees.

Figure 8 shows the answers given to the fourth and last statement, 'I eat more of certain foods to make sure I consume enough protein'. The data is given in frequency of the options chosen.

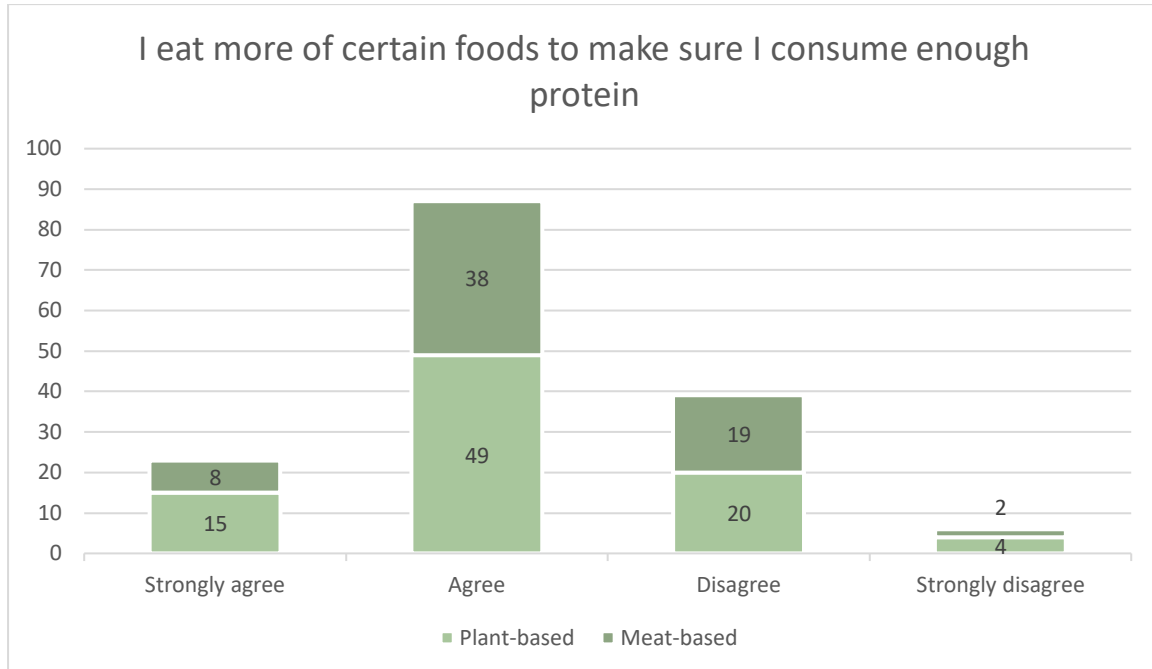


FIGURE 8: OPINIONS ON FOOD CONSUMPTION RELATED TO PROTEIN INTAKE

Most of the respondents, 56%, agree with this statement. 15% of the respondents strongly agree. 25% disagrees with this statement and a minority of 4% strongly disagrees.

3.2 Protein Intake

Each participant indicated the number of portions consumed for ten different food groups. Based on the frequency of consumption of each food group, an estimated protein intake is calculated per participant. The protein intake of the 88 plant-based consumers and 67 meat-based consumers are presented in figure 9. The data is given in grams of protein per day consumed by participants, given in an order of least to most.

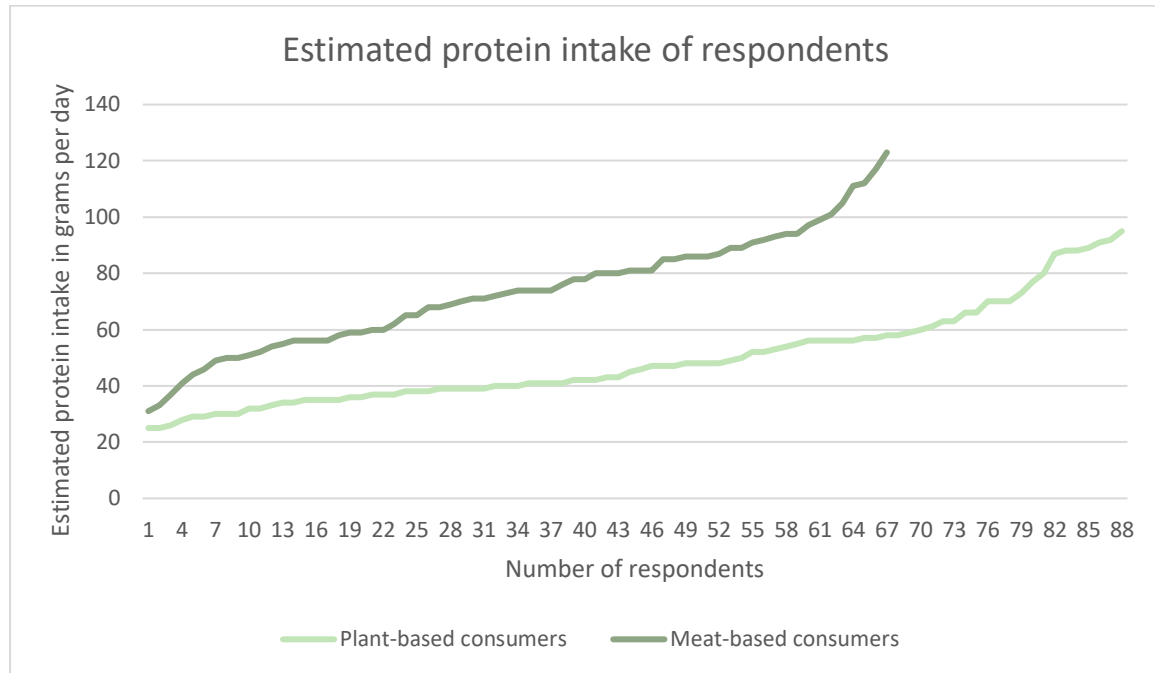


FIGURE 9: ESTIMATED PROTEIN INTAKE OF PLANT-BASED AND MEAT-BASED CONSUMERS

Among the Dutch plant-based consumers, the mean of the estimated protein intake is 49.5 grams of protein per day (346.5 grams of protein per week). The lowest estimated protein intake calculated among the plant-based consumers is 25 grams per day. The respondents with the highest estimated protein intake per day was calculated at 95 grams per day.

The estimated protein intake among Dutch meat-based consumers has a mean of 73.2 grams per day (512.4 grams of protein per week). The lowest estimated protein intake calculated among the meat-based consumers is 31 grams per day. The highest estimated protein intake calculated among the meat-based consumers is 123 grams per day.

The mean of the estimated protein intake among all respondents is 59.7 grams per day.

3.3 Most Frequently Consumed Plant-Protein Sources

There are 6 plant-protein food groups in total, given in the questionnaire. These are, plant-based dairy, cereals, nuts and seeds, legumes, meat substitutes and protein-rich products. The protein intake per food group in total, both meat-based and plant-based consumers. The total estimated protein intake for the 6 plant-based food groups is given in figure 10 below. The data is given in grams of protein (x1,000) per food group.

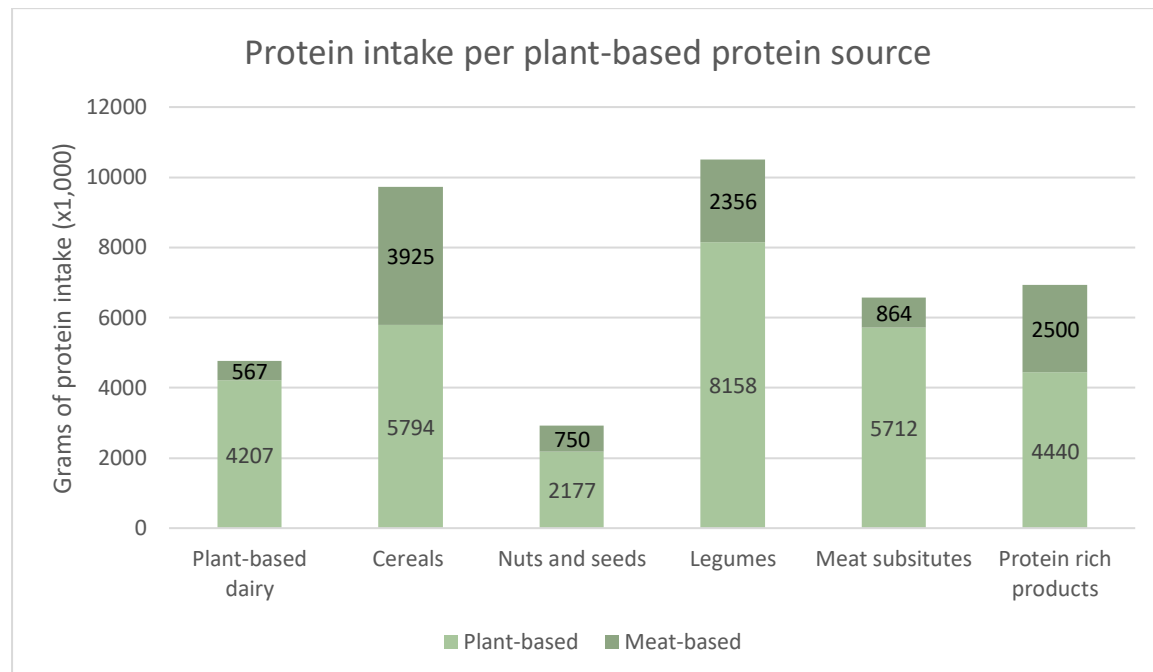


FIGURE 10: TOTAL ESTIMATED PROTEIN INTAKE PER PLANT-BASED PROTEIN SOURCE

Within these 6 food groups, a total of 41,447 grams of plant-based protein is consumed. Legumes account for 25% (10,514 grams) of all plant-based protein within these 6 food groups. The food group cereals are the second biggest source of plant-based protein, which accounts for 23% (9,719 grams) of all plant-based protein. Protein rich products such as protein powders, bars, and other products account for 17% (6,940 grams) and meat substitutes account for 16% (6,576 grams). The two food groups which contributed the least to the total grams of plant-protein consumed are plant-based dairy, which accounted for 12% (4,774 grams) and nuts and seeds which accounted for 7% (2,927 grams).

4. Discussion of Results

The general objective of this research is to identify protein consumption patterns among Dutch meat-based and plant-based consumers. The data was gathered by means of a survey, which was completed by 88 Dutch plant-based consumers and 67 Dutch meat-based consumers. The data collected was downloaded into an MS Excel document, which was subsequently used as the main source of this research. A comparison test was done on the data collected by using an independent T-test to indicate a possible significant difference.

4.1 Protein Intake amongst Dutch Meat-Based and Plant-Based Consumers

The protein intake amongst Dutch plant-based consumers has been measured using an online survey. The respondents had to indicate how many times different foods were consumed within the timespan of a week. The foods are divided into 10 different food groups, representing the main protein sources. Based on the estimated food intake of each respondent and the average protein content per food group (table 2), an estimated protein intake amongst Dutch plant-based and meat-based consumers has been calculated.

The average estimated protein intake for Dutch plant-based consumers is 346.5 grams of protein per week. This results in an average estimated protein intake of 49.5 grams of protein per day amongst Dutch plant-based consumers.

The average estimated protein intake for Dutch meat-based consumers is 512.4 grams of protein per week. Which results in an average estimated protein intake of 73.2 grams of protein per day amongst Dutch meat-based consumers.

An Independent T-test was used to determine whether there is a significant difference between the estimated protein intake from plant-based and meat-based consumers. The Null hypothesis was rejected. Thus, a significant difference is detected amongst the two groups of consumers. The two means of the independent group, plant-based and meat-based consumers, are statistically different.

As given in the introduction, a recommended protein intake is 0,83 grams per kilogram of body weight (Voedingscentrum, 2021). The protein intake is most likely sufficient for most plant-based consumers, meaning the average body weight would be 60 kilograms. It cannot be proven that plant-based consumers who participated in this research consume sufficient protein. Meat-based consumers do most likely also consume enough protein, meaning the average body weight for meat-based consumers would be 88 kilograms. These speculations of average body weight per consumer group cannot be proven for this research.

Another possibility is that meat-based consumers consume too much protein and therefore store the excessive protein as fat in their body. As given in the introduction, this could result in a higher body weight compared to consumers who do not store the excessive protein as fat.

The research which has been previously mentioned in the introduction, about the dietary intake of adolescent vegans and omnivores, showed a lower protein intake among young vegans compared to the young omnivores in Sweden. Another similarity is the fact that the protein intake of the young vegans in Sweden was still above the recommended protein intake (Larsson & Johansson, 2002). Both these points are also present in this research.

In addition, the research mentioned in the introduction, about the macro and micro-nutrient intake amongst Danish vegans and DANSDA, also showed a lower protein intake amongst Danish vegans compared to the general population (Kristensen et al., 2015). This once again shows similarities to this research.

4.2 Main Plant Protein Source

The main plant protein source for both plant-based and meat-based consumers is calculated by adding all estimated protein grams per participant per food group. This data gives the total protein consumed by all respondents per plant-protein source (figure 10).

The data shows legumes is the main plant-protein source for Dutch consumers (plant-based and meat-based). The main plant protein source specifically for plant-based consumers is also legumes. However, the main plant protein source for meat-based consumers is cereals. This is most likely caused because the main protein source for meat-based consumers is not plant based. For plant-based consumers, legumes are often used as a substantial protein source and are therefore the main plant-protein source detected in this research for Dutch plant-based consumers. In addition, cereals are often consumed three times a day amongst Dutch consumers. Cereals are not often eaten as a source of protein. However, cereals do most often contain a significant amount of protein. A frequently consumed food group with a moderate protein content, results in a large amount of protein consumed. Therefore, cereals are a large contributor to all estimated protein consumed amongst the respondents of this survey (figure 10).

4.3 Importance of Protein Intake

The importance of the total protein intake for plant-based and meat-based consumers is based on opinions given to three different statements.

Most plant-based and meat-based consumers (145 of the 155 respondents) indicated they consume enough protein every day in the first statement. This most likely is caused by protein awareness within the chosen diet and knowing what to consume. Nearly all respondents (148 of the 155) think it is important to consume enough protein. The biggest difference is visible when looking at the answers given to the statement 'I eat more of certain foods to make sure I consume enough protein'. 64 plant-based respondents indicated they eat more of certain foods to consume enough protein, compared to 46 meat-based consumers. This indicates plant-based consumers are more likely to be aware of the amount of protein consumed than meat-based consumers.

As shown in the introduction, plant-based consumers consume different protein sources as meat-based consumers, such as legumes, meat alternatives and nuts. When following a plant-based diet, these protein sources become part of the diet. Legumes for plant-based consumers are like meat for meat-based consumers. Meaning, they form the main protein source. In addition, nuts and seeds, meat alternatives and plant-based dairy provide protein when following a plant-based diet. Comparable to dairy and eggs for meat-based consumers.

4.4 Reflection of conducted research

The research process ran according to the proposed research plan. The survey was successfully answered by 155 respondents. This survey was distributed through social platforms which included Facebook, Instagram, and LinkedIn. Facebook groups which included the target group, such as vegan and omnivore groups, were useful to reach respondents.

To conduct a reliable research, 151 respondents were required to participate. This goal was reached within 10 days, with a total of 155 respondents. A 95% confidence level was used with an 8% margin of error (SurveyMonkey, 2021).

The results were predicted and therefore no changes are needed.

A potential limitation of this research includes the fact that only 155 consumers were part of this research. This is enough to conduct reliable research, however, this figure does not represent the total population of the Netherlands. In addition, foods had to be divided into food groups, which makes the protein intake an estimation and not exact figure. For example, eating bread and quinoa both fall under the food group cereals, however, the two foods have a completely different protein intake. It is hard to pinpoint the exact protein intake of consumers unless a diet is checked over a significant period. Thus, recalling what a consumer eats on average per week is often difficult and might result in unrealistic data given in the survey.

5. Conclusion and Recommendations

In this chapter, the main question of this research will be answered by using the answers for the four sub-questions. This research aims to identify the protein consumption patterns of Dutch plant-based consumers and meat-based consumers. This data can be used by businesses and other entities operating within the food market, consumers who want to inform themselves about different diets as well as governmental organizations.

A plant-based diet has a smaller ecological footprint compared to a meat-based diet. Therefore, certain changes need to be implemented by consumers to take control and address climate change and the issues associated to it. Following a plant-based diet should be done responsibly with particular attention to proper macro nutrient intake, including protein. Therefore, a change among consumer choices as well as businesses actions is needed.

5.1 Conclusion

The first sub-question indicates that the average estimated protein intake for plant-based consumers in the Netherlands is 49.5 grams per day. The second sub-question indicates that the average estimated protein intake for meat-based consumers in the Netherlands is 73.2 grams per day. The protein intake for plant-based consumers is lower compared to meat-based consumers. However, it is likely that enough protein is consumed by both groups of consumers daily. No exact facts can be given because of insufficient data collected; this regards body weight per respondent.

The third sub-question indicates that the main plant-protein source for plant-based consumers is legumes. The main plant-protein source for meat-based consumers are cereals. This is likely because legumes are not a big part of the diet of meat-based consumers. Cereals, which are mostly plant-based, are often consumed by Dutch consumers and are therefore the main plant-protein source for meat-based consumers. Cereals are a big protein source for plant-based consumers as well.

The fourth sub-question discovered that protein intake is equally as important for plant- and meat-based consumers. However, data also shows that plant-based consumers are likely more aware of their protein intake since certain foods need to be consumed. Whereas, for meat-based consumers, protein rich foods are often a big part of their diet.

The main research question is as follows, 'What are the differences in protein consumption patterns between Dutch meat-based and plant-based consumers?'.

One of the biggest differences is the protein intake between the two groups of consumers.

Dutch plant-based consumers have a lower protein intake than meat-based consumers.

Another difference is the main plant-protein sources for both groups. The main protein source for plant-based consumers is legumes whereas cereals is the biggest plant-protein source for meat-based consumers. The main protein source for meat-based consumers is not plant-based.

The protein intake for plant-based consumers is important as well as for meat-based consumers.

It is likely that plant-based consumers are more aware of their protein intake when the protein intake for meat-based consumers is not an attention point within the diet.

5.2 Recommendations

In this sub-chapter, recommendations for consumers, business and other entities will be given by using the information provided in the sub-chapter above.

The main plant-protein source for plant-based consumers are legumes. Therefore, legumes could be marketed in a way which promotes protein intake among plant-based consumers. An example is to put a text on the packaging which highlights the fact that the food is full of protein. In addition, online or offline marketing could put a major focus on the protein content of legumes. To be specific, an example is to put 'easy, delicious and protein rich' on the packaging of red lentils. This does not only show the consumer that it contains protein, but it also indicates it is easy to use and prepare.

Businesses who want to enter the legume market in 2022 could consider highlighting the protein content of their products. It is recommended to not specify it is a plant-protein source on for example the packaging, since it possibly limits the target group of the products.

It is likely that protein will become increasingly important in the future for consumers as well as businesses. Therefore, it is recommended to include a protein highlight in future goals or strategies. For example, reformulating existing products which have a higher protein content and subsequently using the increased protein content in future marketing strategies.

Consumers who want to follow a plant-based diet are recommended to be informed about the protein intake and protein sources within the plant-based diet. Keeping track of the protein intake during the beginning phase of following a plant-based diet is recommended. Often, sufficient protein is consumed, however, the consumer needs to be informed about proper protein sources and knowing what to eat. For example, eating legumes as a protein source instead of a large quantity of cereals. In addition to protein, other nutrients are recommended to be tracked within the beginning phase. Transitioning from a meat-based to a plant-based diet comes with certain challenges and disciplines. It is vital that consumers are aware of the nutrient intake, which in the process of transition may lack or neglect. With proper nutrient intake awareness, it can be inferred that a healthy diet is likely to be performed by consumers.

Governmental organizations are recommended to activate consumers to consume more plant-protein and/or plant-based foods. Since a meat-based diet has a much bigger ecological footprint compared to a plant-based diet, therefore it is an easy way to decrease the ecological footprint of consumers. A long-term recommendation is to set a goal for percentage of plant-based protein should be consumed within a certain area. For example, setting a goal of 80% plant-based protein intake for Dutch consumers within the upcoming 5 years.

Furthermore, research is needed to identify whether Dutch plant-based and meat-based consumers have a sufficient protein intake. It is recommended to ask for body weight in kilograms to calculate a sufficient protein intake per participant. In addition, this research shows an estimated protein intake based on the consumed frequency of protein rich food groups. An

exact protein intake could be researched by asking respondents to keep track of the diets over a specific time span. Finally, it can be firmly suggested that this research will display similar results.

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Appendices

Appendix A: Questionnaire

Thank you in advance for taking the time to complete this survey.

My name is Savan Heijnen, a fourth-year student of International Food Business at Aeres University of Applied Sciences. For my thesis, I am researching the protein intake of vegans and omnivores. Existing studies have shown that protein intake is a barrier for people who want to switch to a plant-based diet. I want to do further research into this topic.

The questionnaire is divided into four parts, starting with orientation, followed by statements, followed by 10 food groups, and ending with general information. For each food group you can enter how many servings you eat on average per week. The average portion size is indicated in grams. Please try to show a realistic picture of your weekly protein intake.

The research is anonymous, and data is not shared with third parties.

This survey takes 5 to 10 minutes. If you have any questions or comments, feel free to send an email to savan.heijnen@gmail.com.

Thanks again!

Best regards,
Savan Heijnen

1. Are you on any of the following diets?
 - a) Plant-based (plants only)
 - b) Omnivores (plants and animals)
 - c) None of the above. You do not belong to the target group of this questionnaire. Do not complete the questionnaire further.
2. What is your nationality?
 - a) Dutch
 - b) Otherwise. You do not belong to the target group of this questionnaire. Do not complete the questionnaire further.

To what extent do you agree with the following statements?

3. If you do not consume meat, you will eat enough protein.
 - a) Strongly disagree
 - b) Disagree
 - c) Agree

- d) Strongly agree
4. I get enough protein in one day from my diet.
- a) Strongly disagree
 - b) Disagree
 - c) Agree
 - d) Strongly agree
5. I think it is important to get enough protein from my diet.
- a) Strongly disagree
 - b) Disagree
 - c) Agree
 - d) Strongly agree
6. I eat more of certain foods to make sure I consume enough protein.
- a) Strongly disagree
 - b) Disagree
 - c) Agree
 - d) Strongly agree

Meat consumption

Indicate how many portions of chicken, pork, beef, lamb, and/or turkey you consume per week.

7. How many portions of meat (125g) do you consume per week on average?
- a) 0
 - b) 1
 - c) 2
 - d) 3
 - e) 4
 - f) 5
 - g) 6
 - h) 7
 - i) Other,

Fish and shellfish consumption

Indicate how many portions of salmon, tuna, tilapia, herring, cod, sardines, mackerel, trout, lobster, crab, mussels, shrimp and/or scallops you consume per week.

8. How many portions of fish and/or shellfish (100g) do you consume per week on average?
- a) 0
 - b) 1

- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) Other,

Dairy consumption

Indicate how many portions of yoghurt, cheese, cow's milk and/or butter you consume per week.

9. How many servings of dairy (200g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) 8
- j) 9
- k) 10
- l) 11
- m) 12
- n) 13
- o) 14
- p) Other,

Egg consumption

Indicate how many eggs you consume per week.

10. How many eggs do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6

- h) 7
- i) Other,

Plant-based dairy consumption

Indicate how many portions of almond-, soy-, oat-, coconut milk, plant-based cheese, plant-based yoghurt and/or butter you consume per week.

11. How many servings of plant-based dairy (200g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) Other,

Cereal consumption

Indicate how many portions of bread, crackers, rice, pasta, quinoa, couscous, oatmeal and/or wraps you consume per week. Two slices of bread count as one serving.

12. How many servings of cereals (75g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) 8
- j) 9
- k) 10
- l) 11
- m) 12
- n) 13
- o) 14
- p) Other,

Nuts and seed consumption

Indicate how many portions of almonds, walnuts, hazelnuts, macadamias, cashews, pistachios, peanuts, pecans, peanut butter, tahini, hemp seeds, chia seeds and/or sunflower seeds you consume per week.

13. How many servings of nuts and/or seeds (20g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) Other,

Legume consumption

Indicate how many portions of lentils, chickpeas, edamame beans, pinto beans, black beans, lima beans, peas, mung beans, green beans and/or hummus you consume per week.

14. How many servings of legumes (150g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) Other,

Meat substitutes consumption

Indicate how many portions of tofu, soy chunks, tempeh, seitan, jackfruit, falafel, veggie burgers and/or nutburgers you consume per week.

15. How many servings of meat substitutes (75g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4

- f) 5
- g) 6
- h) 7
- i) Other,

Protein-enriched products consumption

Indicate how many portions of (protein powders, protein pasta, protein bars etc.) you consume per week.

16. How many servings of protein-enriched products (30g) do you consume per week on average?

- a) 0
- b) 1
- c) 2
- d) 3
- e) 4
- f) 5
- g) 6
- h) 7
- i) Other,

General information

17. What is your gender?

- a) Woman
- b) Man
- c) Otherwise
- d) Prefer not to say

18. How old are you?

- a) 18-24
- b) 25-34
- c) 35-44
- d) 45-54
- e) 55-64
- f) 65-75
- g) Prefer not to say
- h) Other....

19. What is your highest obtained degree?

- a) Primary school
- b) High school

- c) MBO
- d) HBO or WO bachelor
- e) Master or PhD
- f) Prefer not to say

20. What kind of household do you currently live in?

- a) Shared housing
- b) Student housing
- c) Single/couple
- d) Family household
- e) Prefer not to say
- f) Other....