



OVERCOMING THE WESTERN AVERSION TO EATING INSECT

A quantitative research on the mindset of Dutch
consumers towards insect-based food products

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Preface

My name is Daniël Koek, I study International Food Business at the Aeres University of applied sciences in Dronten, and this research is my graduation project. Among other things, my years at this university have made me more aware of the challenges that the food industry is facing. Initially, the first year's Study Tour to the EXPO Milano of 2015 opened my eyes to the world food problem. The issue of feeding the world's growing population has inspired me to look for solutions. I learned that there is great potential for edible insects to help ensure a sustainable food supply for the future. However, overcoming the western aversion towards eating insects comes with its challenges.

Special thanks to my coach Kees Schipper for helping me to narrow down this topic and keeping me on track.

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Summary

The number of people that live on the earth continues to grow. However, the amount of food that traditional farming can provide is limited. On top of that livestock farming is not a sustainable food source and the environment suffers a great deal. Therefore, it is essential to look for alternative sources of protein to ensure a dependable food source for generations to come. Edible insects are an environmentally friendly food source with great nutritional benefits, but the western distaste for edible insects is the biggest problem. Therefore, the main research question answered in this paper is: How can the aversion to eating insects among Dutch consumers be overcome?

In order to further investigate the mentality of Dutch consumers towards edible insects a questionnaire was created using Google Forms, and randomly spread through Facebook, LinkedIn, and WhatsApp. The choice for quantitative research was made so that a large amount of data could be collected. Exactly 100 responses were collected from ages 13 to 65. The results were analyzed per age group and as a whole. The use of multiple-choice questions made the data suitable for additional statistical analysis.

One of the most important findings is that young people between 13 and 25 are on average a lot more open to trying edible insects than older people. Another valuable discovery is that insects are a lot more appealing to eat if they are processed into familiar foods. Producers need to know that whole insect (roasted) are generally very unappealing to Dutch consumers. There is a market for edible insects in The Netherlands, at least amongst young consumers. Preferably, the insects should be unrecognizable and processed into foods that consumers already know. The main attribute that sparks the interest in edible insects is the environmental benefits.

The collected findings in this study are beneficial for producers of insect food products as well as businesses that want to sell these products to Dutch consumers. Based on the results the marketing of edible insects should be directed towards young, hip people. For example, by selling these products at organic food stores and festivals. The edible insects can be processed into protein bars, chips, cookies etcetera and appeal to customers with environmental packaging. This research involves the mindset of Dutch consumers but not their actual experience. Therefore, it would be interesting to do future research by taste-testing.

1. Introduction

More than 2 billion people around the world eat insects on a regular basis. A wide variety of edible insects are consumed in the rural and tropical areas of Africa, Asia and Latin America. Some popular insect dishes include: 'Chapulines' a Mexican specialty with fried grasshoppers, 'Beondegi' a classic South Korean street food consisting of silkworm pupae insects, and 'Mod daeng' made from the eggs of weaver ants which can be found in the northeast of Thailand. In total there are around 2000 species of insects that can be safely consumed. Most of these species are harvested from the wild, but only around nine insect species are currently farmed for food and feed. It is recommended by the European Food Safety Authority to only consume farmed insects because this is the only way to ensure that they are not contaminated with heavy metals, pesticides or other toxins ("Risk Profile Related to Production and Consumption of Insects as Food and Feed," 2015).

In The Netherlands and most of the Western world the consumption of insects is rare. The exception is the small amounts of insect parts that are indirectly consumed through the ingestion of processed foods such as bread, peanut butter and chocolate. These products may only contain the maximum amounts of insect parts as established by the FDA; this is allowed because low levels of contamination are considered unavoidable. Generally, insects are not seen as a legitimate food source in western cultures. 'Entomophagy', which is the technical term for eating insects is often associated with primitive behaviour and tends to bring about disgust in western people (Costa-Neto & Dunkel, 2016).

Previous research says that disgust is the main reason for the aversion to insects as food. Food neophobia, the fear of unfamiliar food, is also often mentioned as a potential cause. Whether something is familiar, is of course culturally dependent. The feeling of disgust may seem like a natural instinct, but it too is dependent on culture. This is apparent because plenty of people from different cultures enjoy eating insects. Disgust is a learned behaviour that is acquired in early childhood. It is thought to protect individuals from potential sources of disease. In the West insects are seen as pests and are associated with the spread of disease; therefore, the disgust mechanism sets in (La Barbera et al., 2018)

Since the beginning of the 19th-century people of Western cultures commonly viewed entomophagy as disgusting, primitive, or a sign of material poverty. A historic explanation is that the early development of agricultural practices in Europe and the domestication of large mammals made the consumption of insects obsolete. With the influence of Aristotle came the hierarchical view of living things with humans at the top of the hierarchy and other (lower) living things at the bottom. At this point, humans were no longer seen as just a part of the living world but believed to be superior. The positive attributes of insects (the lowest of living things) began to be ignored. The psychologist Paul Rozin describes how foods are classified as pleasant or unpleasant, and as appropriate, inappropriate, disgusting, dangerous, or beneficial. This second group of categories is determined by culture. The classifying of insects as disgusting is what prevents many westerners from consuming insects (Costa-Neto & Dunkel, 2016).

The aversion to insects as food is unfortunate because entomophagy has many benefits for both human health and the environment. Edible insects are a sustainable food source with a high concentration of essential amino acids, unsaturated fat, and vitamins B and K. Many other vitamins

(A, D, E, and C) and minerals (K, Na, Ca, Cu, Fe, Zn, Mn and P) are also known to be present in some insects. The exact contents depend on the species as well as the feed. Overall, the nutritional value of insects is comparable to that of meat and fish, however, the taste is very different. Insects are often described as having a nutty flavour this flavour which is also called 'umami' is caused by the insects' high concentration of amino acids (Kouřimská & Adámková, 2016).

In terms of environmental benefits, research has shown that farmed insects have a high feed-to-meat conversion efficiency compared to conventional meat such as poultry, pork, and beef. Another benefit is that the emittance of greenhouse gases and ammonia is much lower, and significantly less drinking water is required for these animals. Insects also require far less space for the same amount of food production because they can be stacked vertically in many layers. Also, the risk of zoonotic infections is expected to be much lower, because insects are much more distant from humans than conventional livestock. In 2013, the Food and Agriculture Organisation (in collaboration with the Wageningen University) published a book called 'Edible insects: future prospects for food and feed security'. The book makes a compelling case for insects as a sustainable food source, and it is based on a wide range of scientific research (FAO, 2013).

Conventional livestock farming has a massive impact on the environment. Hence, there is a great need for alternative sources of protein that are more sustainable. This is important not only for the environment but also for ensuring a reliable food supply in the future. It is crucial to ensure a sustainable food supply, in order to feed future populations. In the past 46 years, the human population has almost doubled in size, from 4 billion in 1974 to now 7.8 billion in 2021. Fortunately, the growth rate has slowed down slightly, currently growing at a rate of around 1.05% per year. The United Nation's most recent estimations suggest that the human population will reach 9,7 billion by 2050 (United Nations , 2019).

On top of that, the rise of average incomes in developing countries leads to higher living standards and therefore more costly dietary preferences such as high protein foods. This is driving up global food demand even more. Food demand is expected to increase with 59% to 98% by 2050. There is a limit to how much food can be produced with conventional farming. To feed the growing human population whilst protecting the environment, the food industry needs to consider new ways to grow more food. Insect farming can be a great solution to the growing need for sustainable food sources (Elferink & Schierhorn, 2016), but therefore the western aversion to insects must be overcome. Unfortunately, the consumption of insects is currently not accepted in the Dutch culture.

Nevertheless, many insect food companies are starting up in different European countries such as France, UK, Belgium and of course the Netherlands. These insect-based producers are trying to make their products appealing to western consumers. Thus, insects are processed into familiar food products such as burgers, pasta, bread, and various snacks. Logically this should help to guide people over the psychological hurdle. Indeed, a study among Belgian consumers suggests that insect-based processed foods have a relatively high rate of acceptance as opposed to whole insects (Thielen, Vermuyten, Storms, Rumpold, & Campenhout, 2018). The edible insect industry is on a rise and its market value is expected to keep growing in the coming years. Globally, the estimated market value of edible insects is forecasted to increase from 406.32 million U.S. dollars in 2018 to about 1.2 billion U.S. dollars by 2023. This is a great prospect for the industry and may inspire many investors (Shahbandeh, 2018).

Many efforts have been made to expose westerners to the entomophagy phenomenon through documentaries, films, media interviews, lectures, and food festivals. A recent example is the Gateway Bug documentary (2017) which won several awards. There have also been several TEDx and TED talks on edible insects. The Milano EXPO (2015) is a future-food themed Universal Exposition, at this event both Belgium and the Netherlands presented insects in their vision for the future of food. Edible insects have been presented as the future of food at many health fairs. A variety of insect food products are available in grocery stores across Europe, and there is a growing number of restaurants with insects on the menu. However, in The Netherlands the availability and range of insect food products is very limited (Costa-Neto & Dunkel, 2016).

There is a high level of uncertainty among those who farm insects for human consumption. This uncertainty is largely due to the lack of consumer acceptance, as well as the often-confusing legal framework. Many western countries do not have regulations in place for edible insects, suggesting that it is not recognized as a food. In the European Union, the production and marketing of edible insects now fall under the Novel Food Regulation (Marberg et al., 2017). This regulation requires insect products to be approved by the European Commission before they can be marketed, which is a long process. However, once a certain insect species is approved, all the products containing it can be marketed and sold (Lähteenmäki-Uutela & Grmelová, 2016). Therefore, it will only be a matter of time for it to become clear what is and is not allowed. Moreover, some EU countries including the Netherlands also use their own national guidelines which are more lenient (N Grabowski, 2019).

Most importantly, the edible insect industry is faced with a major challenge regarding consumer acceptance. The cultural programming of the western world keeps most people from considering insects as food. The aversion to eating insects is deeply ingrained in western culture. Most westerners have been taught that insects are gross, and it will be hard to convince those people to consider insects as part of their diet. This issue is a great barrier for the edible insect industry (Verbeke, 2015).

This research report is intended to help insect-based businesses thrive in the sustainable food sector of the Netherlands, by tackling one of the core reasons for the industry's struggle to breakthrough in the western market and finding the best solutions for this issue. The issue is the westerner's aversion to edible insects. For the edible insect industry to thrive, there needs to be enough demand, which will only occur once the western consumer overcomes the typical aversion to insects. Enough demand for edible insects will give producers the incentive to upscale their production, which will lead to more availability and more competitive pricing. Therefore, the main research question is: *How can the aversion to eating insects among Dutch consumers be overcome?*

The answer to this question was found via the following sub-questions:

Sub-question 1; *What are the most important reasons for Dutch consumers to reject insects?*

Sub-question 2; *Which aspects of eating insects are most compelling for Dutch consumers?*

Sub-question 3; *To what extent are Dutch consumers interested in different types of insect-based products?*

2. Research design and methodology

This chapter explains the research method by which the sub-questions are answered. Answering these questions requires getting more insight into the behaviour and mindset of Dutch consumers. For this research to deliver well-grounded results, it is important to acquire a large amount of data. Hence, a quantitative research was conducted based on a consumer questionnaire. In addition, a brief qualitative research was conducted to study the feelings that Dutch consumers have towards eating insects.

The questionnaire consists mostly of multiple-choice questions, which together lead to the answers for each sub-question. By working with a set of simple and straightforward questions that allow respondents to choose from a range of fixed answers, the collected data is well-suited for further statistical analysis. For the qualitative research 44 people were interviewed. The interviewees were encouraged to give their honest answer on how they feel towards eating insects. The interviews were short but meaningful and included a variety of people of different ages.

The objective for the questionnaire was to reach 100 respondents from ages 20 to 65. The questionnaire is targeted towards adults because this gives an accurate representation of the people that generally buy food. Limiting the targeted age range also helps to rule out any variables that may come with children and/or old age. Assuming 50% of those invited respond, 200 survey requests are sent out. The questionnaire is made using Google Forms, and shared via Facebook, LinkedIn, and WhatsApp. For the questionnaire see Appendix 1.

2.1 Sub-question one

‘What are the most important reasons for Dutch consumers to reject insects?’

Finding out the most important reasons for Dutch consumers to reject insects, will give more insight into the mindset of most Dutch consumers. Answering this question can provide a better understanding of why there is an aversion to eating insects among Dutch consumers. This offers an opportunity for insect businesses in the Netherlands to adjust the marketing of their products.

At the beginning of the questionnaire, the respondent is provided with a brief introduction of edible insects and the insect-based products that are available. The respondent is then asked about his/her age and gender, as well as type of consumer by asking the question: (3) *To what extent do health and sustainability play a role in your food choices?* Options range from ‘not at all’ to ‘very much’.

The following questions are asked to find out the main reasons for rejecting insects as food.

(4) *Does eating insects seem disgusting to you?*

(5) *Are you apprehensive about edible insects because it is a novel food?*

(6) *Would you be more open to try insect-based foods if it were more easily available?*

Each of these questions provides four options ranging from ‘definitely’ to ‘no’, this is to prevent respondents from choosing the middle option out of impulse. This section ends by asking: (7) *Are there any other reasons for you to reject insects as food?* Which allows respondents to provide any potentially unforeseen reasons for rejecting insects as food.

The qualitative research was conducted as an interview involving 3 questions, namely: 1. Have you eaten insects before? 2. Are your feelings towards the consumption of insect positive negative or neutral? 3. How would you describe these feelings?

2.2 Sub-question two

‘Which aspects of eating insects are most compelling for Dutch consumers?’

Insect food-businesses may choose to emphasize those aspects which are most compelling for Dutch consumers in their marketing. Emphasizing those aspects may convince some consumers enough to overcome the initial aversion. The survey question related to this sub-question is:

(8) *To what extent do the following aspects spark your interest for edible insects?* The aspects suggested are nutritional benefits, minimizing environmental impact, and curiosity for a novel food. The respondent is presented with a multiple-choice grid to rate each of these aspects from ‘very compelling’ to ‘not really interesting’.

2.3 Sub-question three

‘To what extent are Dutch consumers interested in different types of insect-based products?’

Edible insects may be more appealing to Dutch consumers in the form of familiar food products such as burgers, protein bars, and various snacks. Identifying the types of insect food products that are most appealing, gives companies an idea of what to do to appeal to Dutch consumers.

Firstly, to answer this sub-question the respondents are asked to: (9) *‘Rate each of the following insect products based on your level of interest from 1-5’*. The insect-based products suggested are insect powder, whole insects (roasted), snacks (chips, cookies etc.), protein bars, insect burgers, and pasta with insect flour. Finally, the respondent is asked: *Have any of the suggested products sparked your interest enough to consider trying them?* The given choices are ‘yes’, ‘no’, and ‘I am not sure’.

2.4 Limitation

Because the multiple-choice questions in the questionnaire are fixed, there is no room for detail, and some specific viewpoints may have been repressed. In addition, the answers that respondents gave in the questionnaire do not necessarily translate into actual behaviour.

2.5 Data analyses

The collected data is transferred into an Excel sheet and organized. Excel’s statistical functions such as COUNT, AVERAGE, and SUM, are then used to perform data calculations. For example, the AVERAGE function is used for data such as ‘rate from 1 to 5’, in order to calculate the mean. After that, Excel’s graphing tools are used to transform the data into orderly and comprehensible graphs to optimally represent the results.

The step-by-step process is as follows:

1. Gathering: Data from the online questionnaire is gathered in Excel
2. Assessment: Checking the data to ensure that there are no errors
3. Organizing: Data is organized into clear and workable tables
4. Analyzing: Data from these tables is transformed into graphs

3. Results

In this chapter, the results from the questionnaire are analyzed. The necessary data are elaborated in order to answer the sub-questions, and in turn the main question 'How can the aversion to eating insects among Dutch consumers be overcome?'. The chapter is divided into three paragraphs, one for each sub-question. Graphs and figures are used to clearly represent the data. A complete overview of all the original data is in the appendices.

The questionnaire starts out with a quick introduction to edible insects. Following that are a series of multiple-choice questions, which when analyzed, should answer the research questions. A total of 100 respondents participated in this research by filling in the questionnaire. The results were separated into the following age groups: 13-25, 26-38, 39-51, 52-65. Grouping the results by age showed that 45% of the answers come from those ages 52-65. All the other age groups (13-25, 26-38, 39-51) have been represented quite evenly. In order to account for the imbalance in the representation of different ages, some of the data has been organized and presented per age group, only where there was a noteworthy difference between the ages.

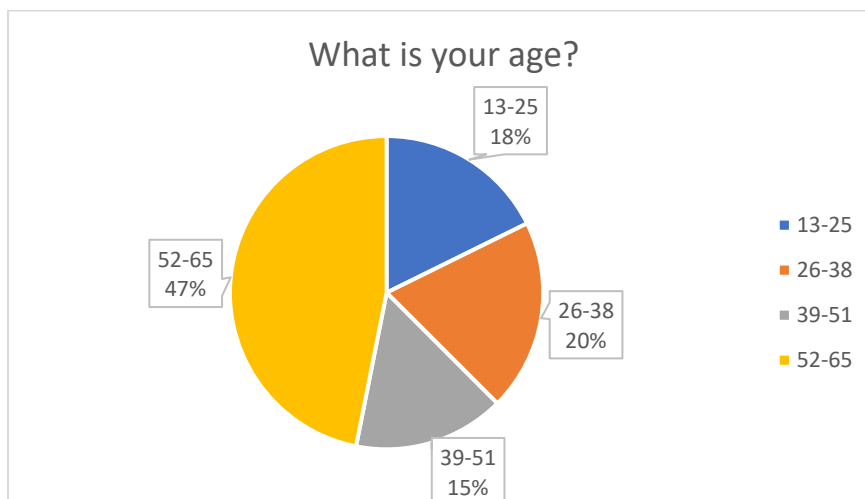


Figure 1. What is your age?

The following paragraphs are a collection of the most relevant data for answering each of the sub-questions.

3.1 What are the most important reasons for Dutch consumers to reject insects?

The intention with regards to this sub-question was to find what the source of the aversion to eating insects is. Pinpointing the roots of this aversion should provide a clearer view of what it is that needs to be overcome. Firstly, the results from the qualitative research show that the feelings that Dutch consumers have towards eating insects are mostly neutral (40,91%) or negative (40,91%). 100% of the negative reactions were from people who have not tried insects. Of the people that responded with neutral feelings 33,33% had eaten insects before. In total only 18,18 % had positive feelings towards eating insects, in this group the ratio of people that had or had not eaten insects was 50/50. The most prominent positive feeling was curiosity. Those who had neutral feelings described it as finding it a bit strange or scary, and not wanting to recognize the insect in the food. Negative reactions included feelings of disgust, fear and disbelief.

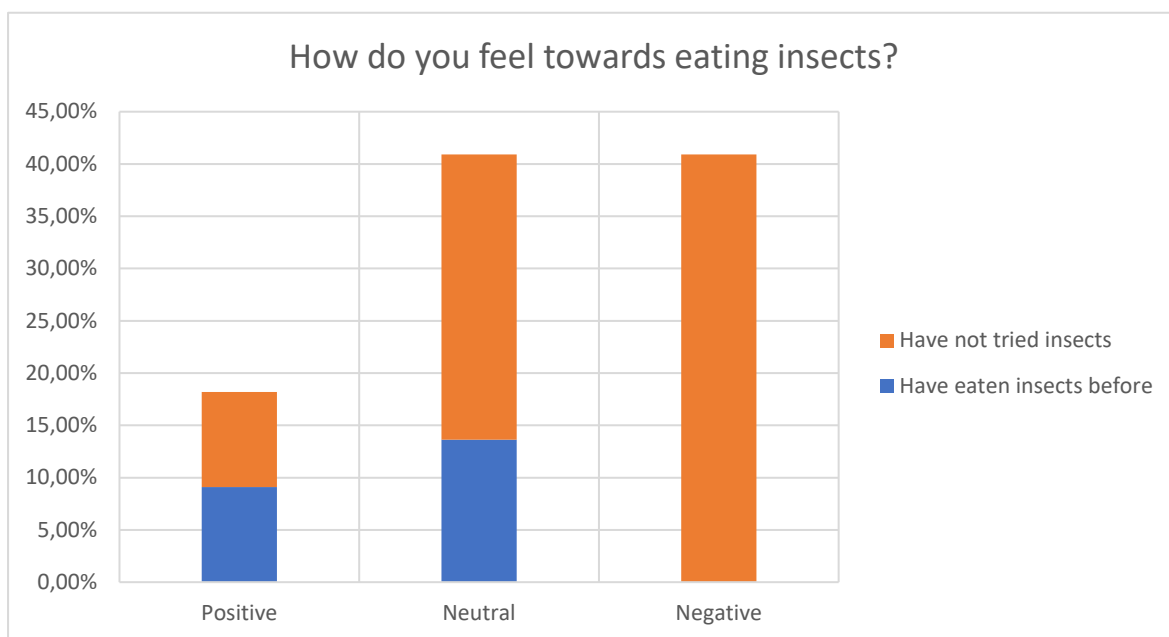


Figure 2. How do you feel towards eating insects?

Based on preliminary research it was assumed that disgust is likely one of the main reasons. The data resulting from the questionnaire indeed shows that the majority of respondents consider the consumption of insects to be at least a little bit disgusting (26% definitely, 37% a little bit). On average 17% of all respondents think insects are 'not at all' disgusting, and 20% said 'no, but I still do not want to try it', which suggests that these people have a different reason to reject eating insects.

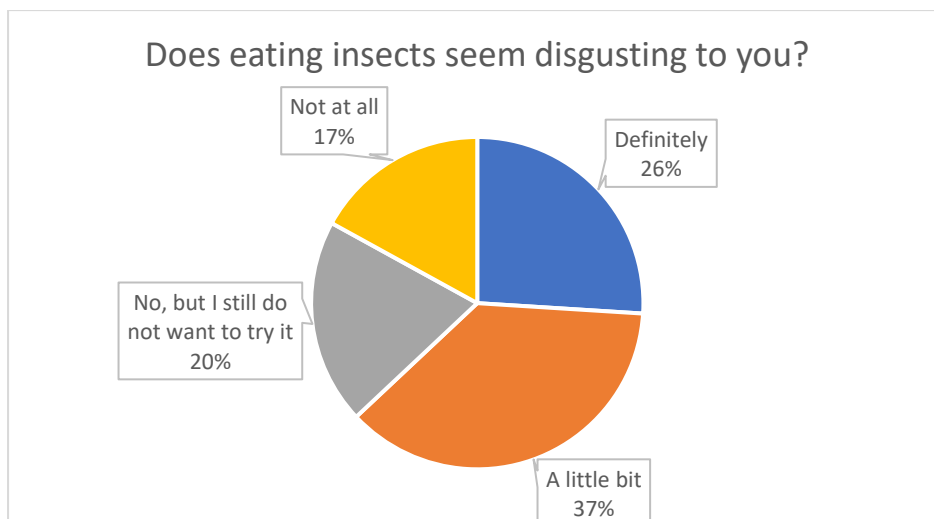


Figure 3. Does eating insects seem disgusting to you?

The results for this question per age group showed that of all the respondents the group of 13 to 25 years old had the least amount of people answering 'definitely' (17,65%) and the most amount answering 'not at all' (23,53%). The group of 26 to 38 years old had by far the most respondents who think eating insects is disgusting (26,32% 'definitely', 52,63% a little bit'). Age groups 39 to 51 and 52 to 65 are more in the middle and fairly similar to each other. The most noteworthy difference is that the oldest group had more people who answered 'not at all' (17,78%) as opposed to the group of 39 to 51 years old (13,33%). The amount of 'not at all' responses from the youngest to the oldest age group are 23,53%, 10,53%, 13,33%, and 17,78% respectively.

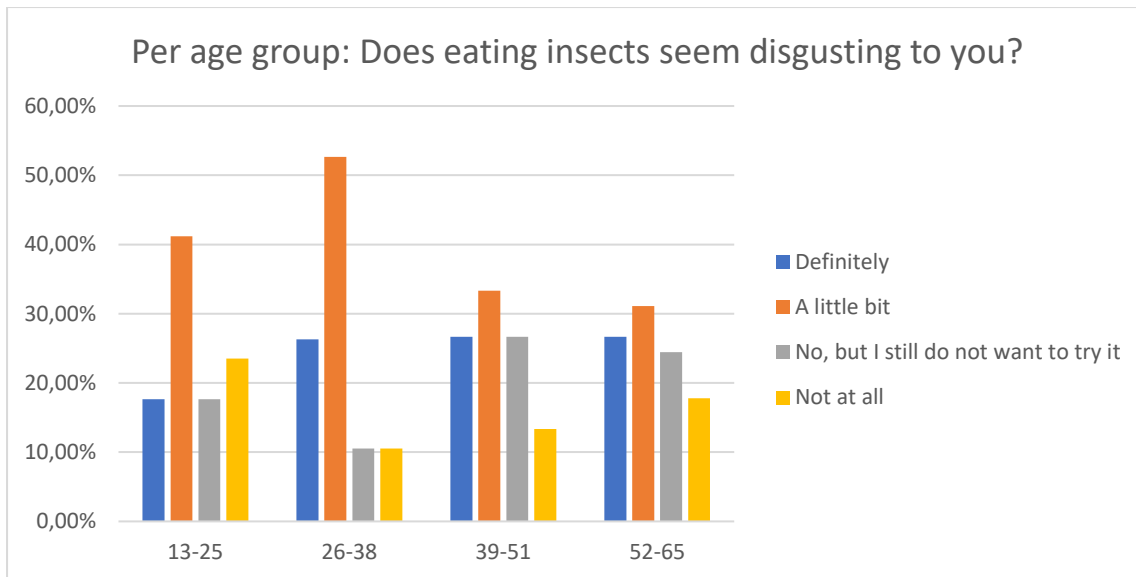


Figure 4. Per age group: Does eating insects seem disgusting to you?

Edible insects are a novel food product in the western market; therefore, people are rarely exposed to them. Edible insect products may not be available in their local supermarket. Could a lack of availability contribute to the rejection of edible insects? In order to find out the following question was posed in the questionnaire: Would you be more open to try insect-based foods if it were more easily available? The resulting data shows that only 12% said 'definitely', 28% said 'probably'. The options 'maybe' and 'no' each represent 30%.

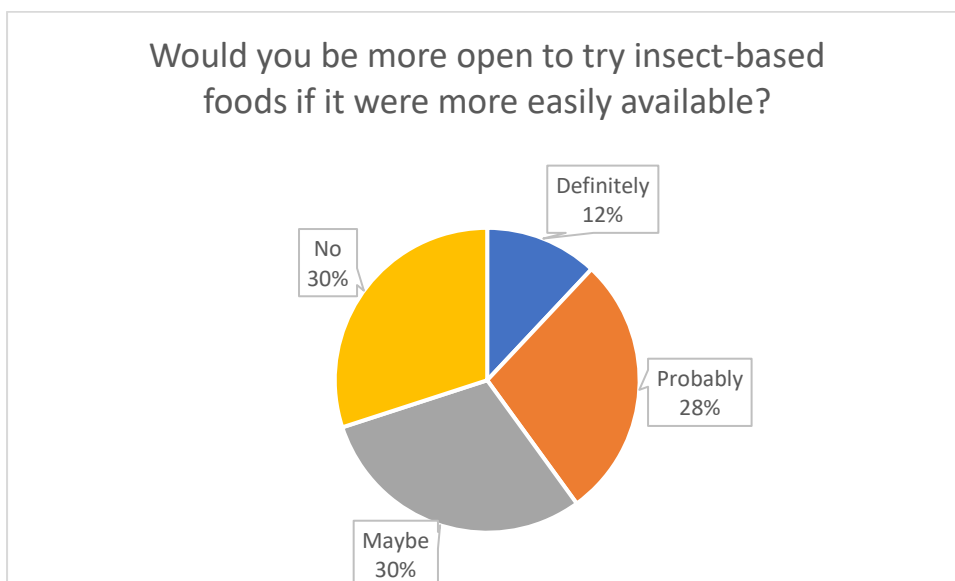


Figure 5. Would you be more open to try insect-based foods if it were more easily available?

The responses to this question are different for every age group. The youngest age group of 13 to 25 had the most positive responses, including 17,65% 'definitely', 35,29% 'probably', and 41,18% maybe. Age group 26 to 38 had by far the most negative responses, 52,63% of them answered 'no'. The two older age groups are again quite similar and more in the middle.

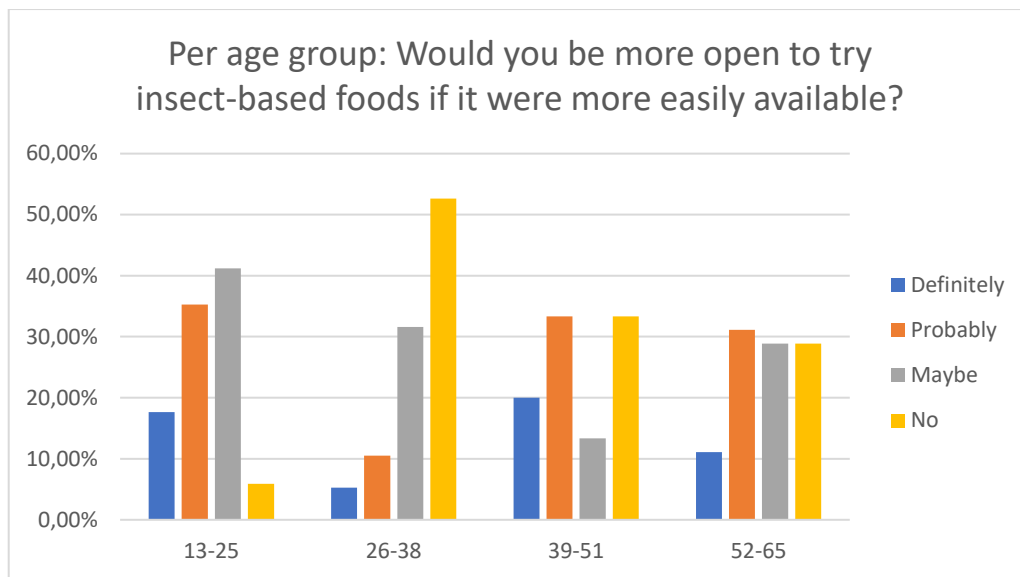


Figure 6. Per age group: Would you be more open to try insect-based foods if it were more easily available?

The next question was: 'Are there any other reasons for you to reject insects as food?'. 26 out of 100 respondents answered 'yes'. These respondents were then asked to elaborate on their reasons. 16 mentioned that they are vegetarian or vegan, therefore they do not eat any animals. The other 10 included reasons such as 'insects are filthy', 'creepy', 'look unappetizing' as well as 'religion' and 'upbringing'.

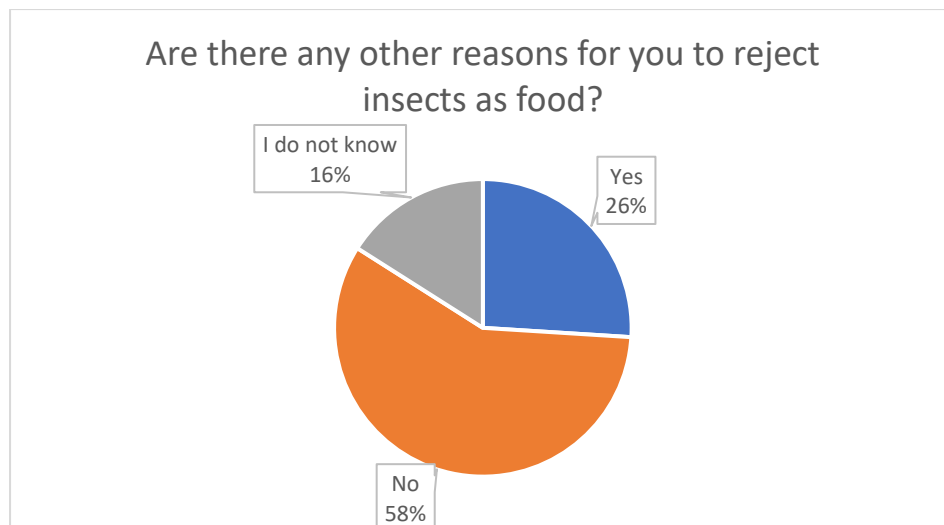


Figure 7. Are there any other reasons for you to reject insects as food?

Grouping the results by age showed that a majority of 57,89% of respondents aged 26 to 38 answered 'yes'. From youngest to oldest the share of respondents that answered 'yes' are 11,76%, 57,89%, 20,00%, and 20,00% respectively.

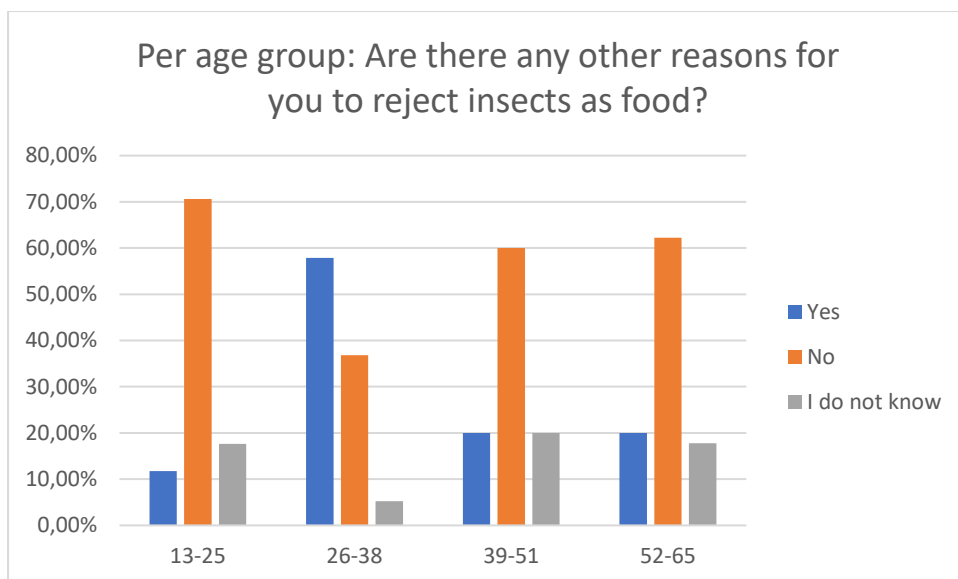


Figure 8. Per age group: Are there any other reasons for you to reject insects as food?

3.2 Which aspects of eating insects are most compelling for Dutch consumers?

There are several aspects to the consumption of insects that may be compelling to Dutch consumers. The most important ones are nutritional benefits, minimizing environmental impact, and curiosity for novel food. Awareness of such benefits should lead to a more positive view of edible insects and more acceptance among consumers.

The question: ‘To what extent do the following aspects spark your interest for edible insects?’ is aimed at finding out which of these aspects are most interesting to Dutch consumers. The nutritional benefits were quite interesting to most respondents (51%), 36% found it very compelling, and 13% said it was not really interesting. The aspect of minimizing environmental impact was very compelling to 53%, quite interesting for 30%, and not really interesting for 17%. Curiosity for a novel food was not really interesting for 46%, quite interesting for 35%, and very compelling for 19%.

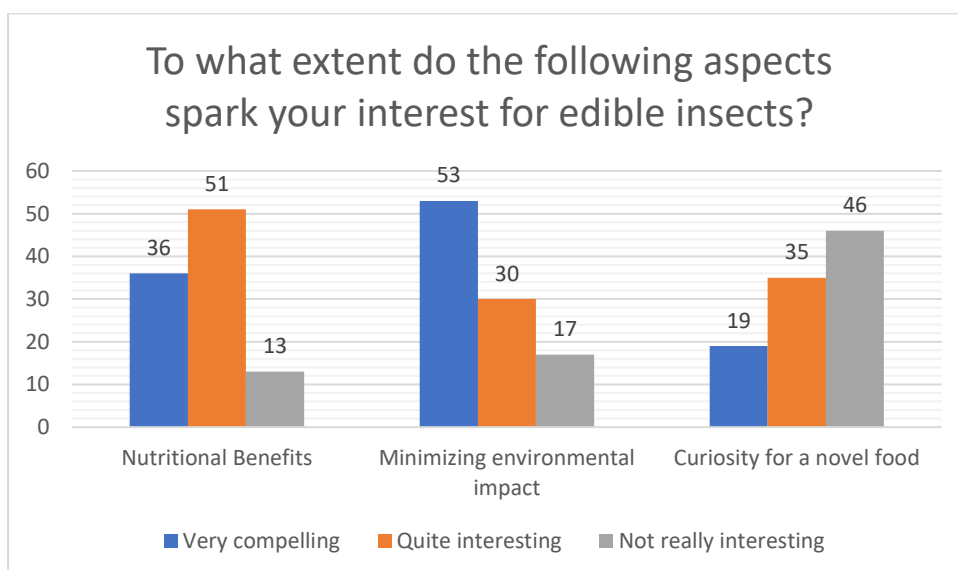


Figure 9. To what extent do the following aspects spark your interest for edible insects?

By isolating the data regarding nutritional benefits and displaying the results for every age group, it becomes clear that there is a difference in the level of interest between the age groups. Respondents aged 13 to 25 seem to be interested in the nutritional benefits of edible insects, 41,18% answered 'very compelling' and 59% answered 'quite interesting'. Of the respondents aged 26 to 38, 47,37% answered 'very compelling', 36,84% answered 'quite interesting', and 15,79% answered 'not really interesting'. The answers from age group 39 to 51 were 33,33% 'very compelling', 60,00% 'quite interesting', and 6,67% 'not really interesting'. The results from age group 52 to 65 are most similar to the total results. This group is least interested in the nutritional benefits, 31,11% answered 'very compelling', 51,11% answered 'quite interesting', and 17,78% answered with 'not really interesting'.

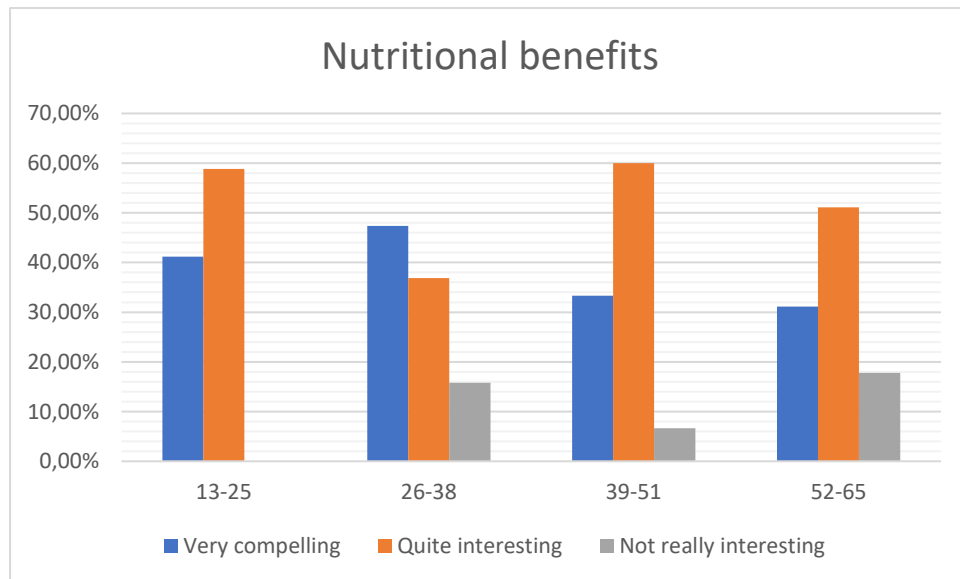


Figure 10. Nutritional benefits

The level of interest regarding minimizing environmental impact follows a similar pattern in every age group. The results differ slightly but are not noteworthy.

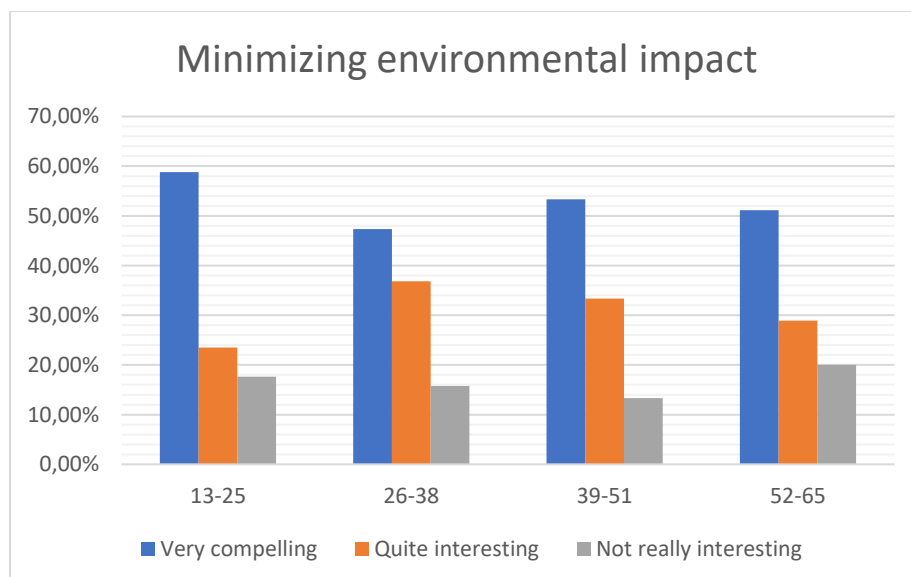


Figure 11. Minimizing environmental impact

Curiosity for a novel food was largely rated as 'not really interesting' for most age groups. The age group of 13 to 25 stands out with 41,18% answering 'very compelling', in addition, 23,53% answered 'quite interesting', and 35,29% answered 'not really interesting'. In contrast, of the respondents in age group 26 to 38, only 10,53% answered with 'very compelling'. Furthermore, 42,11% answered 'quite interesting', and 47,37% answered 'not really interesting'. Age group 39 to 51 answered 13,33% 'very compelling', 26,67% 'quite interesting', and 60,00% 'not really interesting'. The results from age group 52 to 65 are most similar to the total results with 17,78% 'very compelling', 37,78% 'quite interesting', and 44,44% 'not really interesting'.

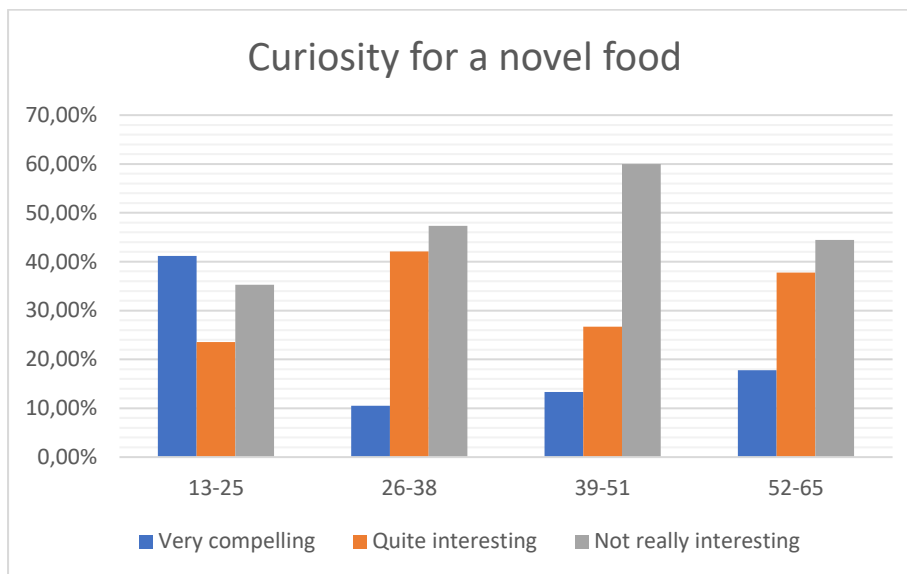


Figure 12. Curiosity for a novel food

3.3 To what extent are Dutch consumers interested in different types of insect-based products?

There are different types of insect-based foods available. Respondents were asked to rate their level of interest from 1 to 5, regarding the following products: insect powder, whole insects (roasted), snacks (chips, cookies etc.), protein bars, insect burgers, and pasta with insect flour. The average ratings were 2.32, 2.06, 2.76, 2.74, 2.34, and 2.6 respectively. On average the respondents showed a clear preference for snacks and protein bars, followed by pasta with insect flour, insect burgers, insect powder, and lastly whole insects. All the products were given a dominant rating of 1, indicating no interest. Snacks and protein bars had the most amount of high interest, namely 13% and 12%, followed by insect burgers with 10%, pasta 9%, whole insects 8%, and insect powder 6%.

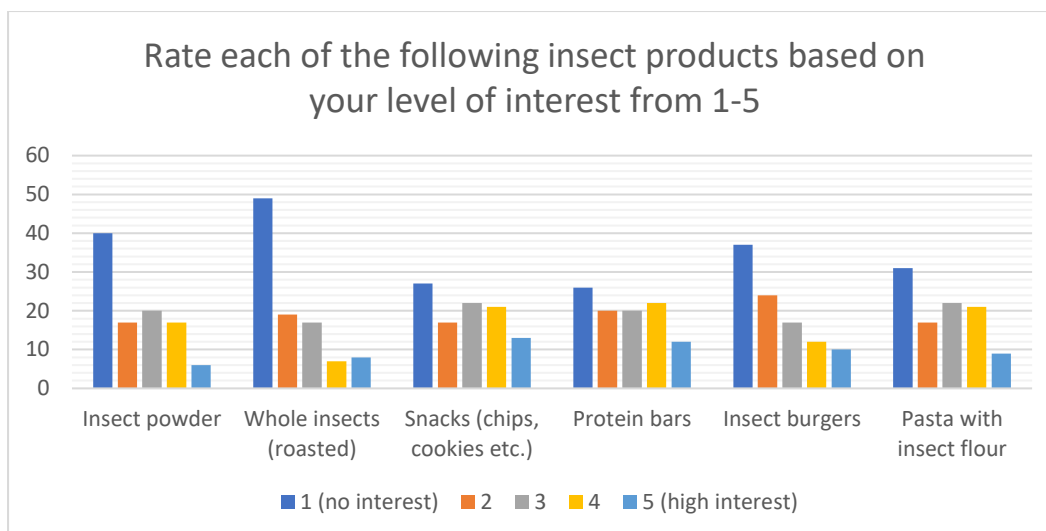


Figure 13. Rate each of the following insect products based on your level of interest from 1-5

Compared to the older age groups, those aged 13 to 25 gave the highest average rating to each of the suggested insect-based foods. This group gave their top rating to snacks (chips, cookies etc.) with on average a 3,47 out of 5. Age group 26 to 38 gave the overall lowest ratings, their top-rated products were protein bars and pasta with insect flour with each a 2.58 out of 5. Age group 39 to 51 also gave very low ratings overall, their top-rated products were protein bars and insect burgers with each a 2,53 out of 5. Finally, the ratings from age group 52 to 65 were quite low as well, their top-rated product was snacks (chips, cookies etc.) with a 2,76 out of 5.

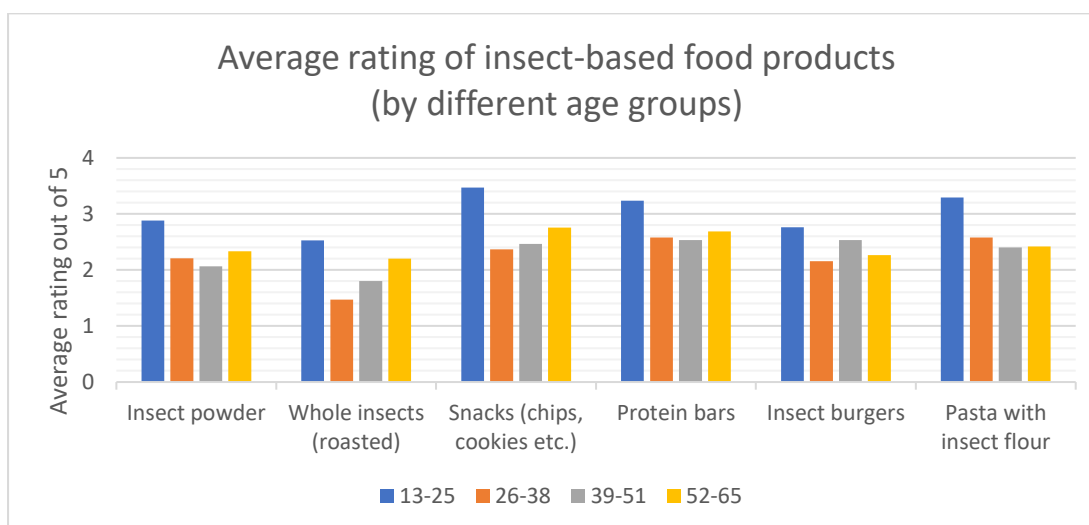


Figure 14. Average rating of insect-based food products (by different age groups)

4. Discussion of results

The objective of this research is to provide insight into the minds of Dutch consumers regarding the consumption of insects. This includes:

1. Investigating the main reasons for Dutch consumers to reject insects.
2. Finding out which aspects of eating insects are most compelling to Dutch consumers.
3. Determining to what extent Dutch consumers are interested in different types of insect-based products.

Together these points will help answer the main research question: 'How can the aversion to eating insects among Dutch consumers be overcome?'. The outcomes of this study are useful for producers of insect food products as well as establishments that are interested in selling insect-based food products to Dutch consumers.

The following is a reflection and short summary of the most important results for each sub-question:

1. What are the most important reasons for Dutch consumers to reject insects?

The people that were interviewed rarely express positive feelings towards the consumption of insects (only 18,18%). For the most part respondents showed negative feelings including disgust, fear and disbelief. Respondents that had eaten insects before had either positive or neutral feelings. This suggests that unfamiliarity plays a role in the negative feelings that Dutch consumers tend to have towards eating insects.

In the questionnaire, respondents gave a variety of reasons for rejecting insects as food. Next to a vegan or vegetarian diet, the most prominent reasons given are feelings of disgust and the sense that insects are creepy, dirty or filthy. These results are in line with the preliminary research, which points to disgust as the main factor (La Barbera et al., 2018) (Costa-Neto & Dunkel, 2016). The questionnaire results show that the level of disgust that most consumers feel is somewhere in the middle ('a little bit disgusted'). This can be interpreted as there is some possibility for these people to change their mind depending on the presentation of these insect food products. This is however not the type of consumer that will be the first in line to try it. Of all the responses, there is only a small group that are not at all disgusted (17%). In the group of 13- to 25-year-olds, slightly more people said that they were not at all disgusted (23,53%). In addition, most people in this age group also said that they would be more open to try insect-based foods if it were more easily available. This indicates that younger people are more open to trying insect food products, and are therefore a better target group for the industry.

2. Which aspects of eating insects are most compelling for Dutch consumers?

The questionnaire results show that the nutritional benefits are a compelling factor to most respondents. In total, 36% of respondents found it very compelling and 51% said that it was quite interesting. The group of 13- to 25-year-olds showed a higher-than-average level of interest with 41,18% responding 'very compelling', and 59% responding 'quite interesting'. Overall, this shows that Dutch consumers tend to have a moderate to high level of interest when it comes to the nutritional benefits of insect consumption. High levels of interest are most prominent among younger people.

When it comes to the potential for edible insects to help minimize the environmental impact, those who responded to the questionnaire generally showed high levels of interest. In total, 53% found it 'very compelling', and 30% 'quite interesting'. The different age groups showed similar results. Overall, minimizing the environmental impact seems to be a slightly more compelling factor to most people, however both factors (minimal impact on the environment & nutritional benefits) seem to be highly valued among Dutch consumers. This is valuable information for those who are trying to promote and sell their insect-based food products to the Dutch consumer. It would be wise to emphasize either of these aspects in the marketing of insect food products. The aspect to emphasize should depend on the target group and the product as well as the mission, vision and intention of the business.

3. To what extent are Dutch consumers interested in different types of insect-based products?

The respondents rated their level of interest regarding a range of products on a scale from 1 to 5. Most of the suggested products were rated quite badly, all products were given a dominant rating of 1, indicating no interest. This is a clear indicator that most people are not yet convinced to eat insect food products in any form. On average the respondents did show a clear preference for snacks (chips, cookies etc.) and protein bars, these products were rated 2.76 and 2.74 respectively. Whole insects were by far the lowest-rated insect product (2.06 total average). This supports the idea that insects are a lot more appealing to eat if they are processed into familiar foods (Thielen, Vermuyten, Storms, Rumpold, & Campenhout, 2018). However, there is clearly still a kind of aversion that keeps most Dutch consumers from embracing insects as food. The different types of products are not enough to convince the average Dutch consumer. The exception seems to be the younger consumers (13 to 25 years old). Respondents in this age group gave the highest average rating to each of the suggested insect-based foods. Their highest-rated product was snacks, rated 3.47. If the young consumer of today represent the average consumer of the future, then it seems that there is a real opportunity for edible insects to be accepted by most Dutch consumers in the future. Currently, edible insects are a niche market in The Netherlands that should only be targeted towards a specific group of people.

The research that was conducted went mostly according to plan. With the questionnaire, the objective was to reach 100 respondents from ages 20 to 65, as is stated in the research design and methodology. This number was reached quicker and more easily than expected, however, it was mostly a short spurt of respondents and after about 10 days the responses stopped coming. The questionnaire was shared via several media platforms and many contacts were happy to participate. In some cases, these contacts also shared the questionnaire with their friends, which made it easier to reach the objective within the set-out time frame. Furthermore, this way of sharing contributed to a more random set of demographics regarding the respondents and little influence and control over the type of people that responded to the questionnaire. This led to some responses that were outside of the planned age range. The results that came back included 2 respondents aged 13 and 1 respondent aged 15. These results were not ignored but included in the analysis of the total data. The most relevant data was presented in the previous chapter.

The questionnaire was made to be very simple and straightforward, which likely contributed to the motivation of respondents to fill in all the questions with care. Only the age was left empty by 4 of the respondents. In hindsight, the decision to make this question optional was not optimal, because age turned out to be an important factor in the data analysis. The questionnaire also included 1 open question about the reasons for people to reject insects. This question was optional yet it was filled in by all the respondents. An array of alternative reasons was given mostly related to veganism and vegetarianism. The fact that some people reject eating insects because of their vegan or vegetarian principles was not considered in the research method. Considering this it may be interesting to look into the opinions and motivations of this specific group of people.

The qualitative research was conducted as an interview, 44 people were interviewed which was enough to deliver meaningful results. Overall, the goal was to find out how Dutch consumers feel when they think of eating insects. In addition, the interviewees were asked if they had ever eaten insects before in order to see how this influences their feelings towards eating insects. Doing these interviews in addition to the questionnaire allowed for a more specific and personal insight into the minds of Dutch consumers in relation to edible insects. As expected, there were only a few interviewees who had eaten insects before and unsurprisingly these people were less likely to have negative feelings towards eating insects. However, this still doesn't make clear what precisely the link is between unfamiliarity and aversion, because the cause-effect relation could be either way.

The choice of methodology was good for the purposes of this research; however, hindsight provides a different perspective that allows for a better judgement. One way that could have improved the quality of this research is the assembly of a focus group to help with the process of developing the questionnaire. The questions asked in the questionnaire can always be more optimal. While making this questionnaire the only outside perspective was from a few close friends and family members, which was helpful but not a high-quality source of feedback. Working with a focus group would have been better. However, it also would have taken up a lot more time because it requires organizing and finding the right people.

The following SWOT analysis shows the strengths, weaknesses, opportunities and threats in relation to insects as food.

Strengths	Weaknesses
<ul style="list-style-type: none"> • High nutritional value (protein rich) • Sustainable food source (low environmental impact) • Variety of products available in some European countries 	<ul style="list-style-type: none"> • Availability of products is very limited in The Netherlands • Lack of acceptance among Dutch consumers • Low demand
Opportunities	Threats
<ul style="list-style-type: none"> • Growing attention from the media • Potential for insects to help feed the growing population • IPIFF representing the interests of the insect production sector towards EU policy makers, European stakeholders and citizens. 	<ul style="list-style-type: none"> • Lack of regulatory clarity • Limited technology and lack of knowledge • Highly competitive market • Culturally ingrained aversion to insects

As the preliminary research shows edible insects have a high nutritional value and are a sustainable food source with low environmental impact. In addition, a variety of products have become available on the European market (FAO, 2013).

In The Netherlands however, the availability of products is very limited. There are only a few available and the products that are available are not impressive. There is clearly a lack of acceptance among Dutch consumers, this is in line with the demand which is also very low or non-existent (Verbeke, 2015).

The growing attention from the Dutch news media in recent years is a great opportunity for the industry, as people become familiar with edible insects the level of acceptance may also grow (Marberg et al., 2017). With the growing population and the forecasted food shortages in the future, there is a great potential for edible insects to be a valuable candidate for feeding the world (FAO, 2013). Lastly, IPIFF (International Platform of Insects for Food and Feed) is an organisation which represents the interests of the insect production sector towards EU policy makers, European stakeholders and citizens. Since IPIFF it was founded in 2015, the organisation now has over 70 members worldwide. If the organisation manages to get the European institutions behind them, the edible insect industry is likely to grow as citizens are encouraged to see insects in a positive light (Edible Insects on the European Market, 2020).

As of now the lack of regulatory clarity is still a threat to industry as it causes a lot of uncertainty. There is also lack of knowledge and experience when it comes to farming insects on a large scale. Lastly there is the culturally ingrained aversion to insects which is causing most Dutch consumers to reject insects as food (Marberg et al., 2017).

5. Conclusions and Recommendations

In this final chapter of the thesis report, the conclusions and recommendations are given based on the most relevant research findings. Every sub-question is answered, and based on those answers the main research question will also be answered.

This report was inspired by the issue of feeding the world's growing population while preserving the environment, and the great potential that edible insects have in helping to ensure a sustainable and nutritious food supply for the future. A great barrier to the success of edible insects in The Netherlands is the aversion that westerners tend to have when it comes to eating insects. Therefore, the main research question: *'How can the aversion to eating insects among Dutch consumers be overcome?'*. This research provides more insight into the mindset of Dutch consumer in relation to edible insects.

5.1 Conclusions

Sub-question 1 is as follows: *'What are the most important reasons for Dutch consumers to reject insects?'*. The results from this research indicate that Dutch consumers (of all ages) tend to be averse to eating insects, largely due to disgust and/or fear. Interestingly, the youngest group of respondents (aged 13 to 25) are less triggered by disgust, 23.53% of them are not at all disgusted by the consumption of insects. As the theory states disgust is a learned behaviour, therefore the cause and cure for this issue are found in upbringing and education (La Barbera et al., 2018). Generally, other factors such as dietary restrictions and food neophobia showed to play a lesser role. Producers and retailers are hesitant about edible insects because of the perceived risk of adopting such a novel food and the typical western distaste for insects. However, the research results show that a fair number of Dutch consumers (between 40% and 70%) would be more open to try insect-based foods if it were more easily available. This is a clear indication that there is a lack of availability in the Dutch marketplace. Especially young consumers seem to be more open to trying edible insects, this tendency is reflected in most of the results from this research. Clearly young consumers are the most fitting target market of all the age groups.

The responses to the various attractive attributes of consuming insects are measured under sub-question 2: *'Which aspects of eating insects are most compelling for Dutch consumers?'*.

Respondents rated the extent to which each of the following aspects sparked their interest for edible insects: 1. nutritional benefits, 2. minimizing environmental impact, and 3. curiosity for novel food. The nutritional benefits showed to be a compelling factor to most respondents, even more so among the younger consumers (13 to 25 years old). Presenting insect-based food products as a health food is a powerful tool that can help get the attention from Dutch consumers. Based on the research results, younger consumers should be targeted in the marketing and promotion of these products in order to fully utilize their marketing potential. The results show that the minimal environmental impact is also a very compelling factor to most respondents. Moreover, this aspect of the edible insects seems to be a slightly more compelling factor on average, however the differences are small. Undoubtedly, the minimal environmental impact is a compelling factor to Dutch consumers, therefore this aspect of the product should play an important role in the marketing as well. Finally, curiosity for a novel food was not really interesting for most, except for some of the younger consumers. Trying to play into the curiosity of Dutch consumers is most likely ineffective. Considering that the nutritional benefits and minimal impact on the environment both spark the interest of Dutch consumers, spreading this message may convince some people to give these insect

food products a try. The results from the interviews show that the people who have eaten insects before did not have negative feelings towards it.

Sub-question 3 is: *'To what extent are Dutch consumers interested in different types of insect-based products?'* Respondents were asked to rate various insect-containing food products on a scale from 1 to 5. Overall, the ratings for all of the presented products were low, most of the average rating were barely a 2.5. However, the research results did show a clear preference for edible insects in the form of processed foods, these products were generally rated above 2.5. Among the lowest-rated products were whole roasted insects followed by insect powder, while products in which the insects are more concealed were rated much more favourably. The highest-rated products were protein bars and various snacks. Especially young consumers (aged 13 to 25) were interested in edible insects, as opposed to the other age groups who were overall less positive. These results suggest that edible insects are more likely to be well-received when they are presented in the context of a familiar product. This reflects the findings from the preliminary research which also states that insects are generally more appealing to eat if they are processed into familiar foods (Thielen, Vermuyten, Storms, Rumpold, & Campenhout, 2018).

To conclude, the aversion to eating insects is common among Dutch consumers of all ages. Young consumers (ages 13 to 25) tend to be more interested and open towards to consumption of insects, this is a great indicator that young consumers are the most fitting customer base. Based on an array of scientific studies from the Radboud University Nijmegen and the Wageningen University as well as the FAO's book 'Edible insects Future prospects for food and feed security', the spread of knowledge about the consumption of insects is a critical step in overcoming the aversion towards insects (FAO, 2013) (Marberg et al., 2017).

According to a 2017 study by Radboud University Nijmegen, there has been a growing number of articles from Dutch news sources that are related to insects for human consumption. The articles were mostly about consumer acceptance and sustainability, and were written with a positive or neutral attitude. This indicates that more people are becoming aware of the potential for insects as food, and the edible insect sector in The Netherlands is becoming more recognized by consumers. The spread of awareness through several media channels such as newspapers is a valuable tool as the edible insect sector is seeking (both legal and) societal approval (Marberg et al., 2017).

Newspapers, magazines, TV cooking shows and other media need to continue promoting the concept of edible insects. Moreover, there should be an emphasize on the many environmental benefits of eating insects as well as the nutritional benefits and the potential for edible insects to help feed our growing population. People need to understand that the consumption of insects is normal and safe. The results from the questionnaire show that Dutch consumers are highly interested in the environmental and nutritional benefits that edible insects offer as opposed to conventional meat. Highlighting these benefits in the marketing, and utilizing edible insects in the production of familiar food products such as snack and protein bars, works to gain the interest of Dutch consumers.

As a writer and food expert, professor Louise Fresco, the chairman of Wageningen University & Research, also frequently addresses the great potential for insects as an alternative protein to feed the growing world population. However, as she mentions in her book 'Hamburgers in het paradijs' (Chapter 5), eating insects requires a great mental step that most Europeans are not willing to make. In the modern western culture, we have an overwhelming distaste for insects, we think that insects are scary. This is quite remarkable because we do eat crustaceans such as shrimp and lobster, which are in essence similar to insects (Fresco, 2012)

When it comes down to it there is only a very small market for edible insects in The Netherlands, and for the time being insect food products are a niche market. Even though there is great potential for the future, there is currently little to no demand for edible insects on the Dutch market, and the undeveloped legal framework in Europe limits the production and sales of insect food products on a commercial scale.

Currently there are only a few insect food products available in The Netherlands, and the consumption of insects is still far from popular. As this research showed Dutch consumers rarely express positive feelings (only 15,6%) towards the consumption of insects. A large part of the responses showed negative feelings (40,6%) such as fear and disgust. As these negative feelings towards insects are so prominent and the consumption of insects is very much in contrast with the Dutch habits, it will likely take a lot more time and effort for Dutch consumers to be excited to eat insects.

5.2 Recommendations

Recommendations in the short term are for producers of insect food products to prioritize the production of familiar processed foods in order to appeal to Dutch consumers. It would also be wise to incorporate some clear and concise information about the nutritional and environmental benefits on the packaging to spark the interest of conscious consumers. To establish and maintain the conscious identity it would be appropriate to use environmentally friendly packaging.

Moreover, edible insects should be promoted at trade fairs and health fairs to draw more attention to their great potential as future food and the array of tasty options that are being developed. Another way to spread awareness and reach young people is through collaboration with schools, discussing the topic of eating insects in the classroom will help to normalize this custom.

Both producers and retailers will benefit from targeting young consumers (but not exclusively). For example, by promoting and selling their products at stands during the festival season. Retailers that are interested in selling edible insect products should adopt the type of products that are already familiar to the consumer, these products would fit well in the natural and organic stores and/or in those sections of the store. Availability plays a role in the willingness of Dutch consumers to try these products, therefore it is the responsibility of producers to tend to the desires of consumers, and that of retailers to adopt these products so that it becomes more available.

In the long term, producers should focus on the development of new tasty snacks or other processed foods as they tend to be most appealing to Dutch consumers. It would be interesting to do research based on taste-testing so that it can be discovered how people experience not only the idea but also the taste of insect-based products. Further research may help in determining the most successful recipes and the associated organoleptic properties that consumers find pleasing.

As edible insects are sustainable source of high-quality protein that requires very little resources to be produced, it has great potential to help fight food shortages in the future. The growing population is expected to become a serious threat to food availability worldwide. The food industry will be looking for new ways to grow more food because the conventional farming methods of today are not equipped to sustain the expected food demand of the future. It is therefore necessary to continue learning and developing methods of farming insects, because there is likely to be a growing demand for high-quality proteins in the future (Elferink & Schierhorn, 2016) (FAO, 2013).

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Appendix 1 - Consumer questionnaire

1. *What is your age?*

.....

2. *What is your gender?*

- ☐ *Male*
- ☐ *Female*

3. *To what extent do health and sustainability play a role in your food choices?*

- ☐ Not at all
- ☐ A little bit
- ☐ Very much

4. *Does eating insects seem disgusting to you?*

- ☐ Definitely
- ☐ A little bit
- ☐ No, but I still do not want to try it
- ☐ Not at all

5. *Are you apprehensive about edible insects because it is a novel food?*

- ☐ Definitely
- ☐ Probably
- ☐ Maybe
- ☐ No

6. *Would you be more open to try insect-based foods if it were more easily available?*

- ☐ Definitely
- ☐ Probably
- ☐ Maybe
- ☐ No

7. *Are there any other reasons for you to reject insects as food?*

- ☐ Yes, namely...
- ☐ No
- ☐ I do not know

8. *To what extent do the following aspects spark your interest for edible insects?*

	Very compelling	Quite interesting	Not really interesting
Nutritional benefits	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Minimizing environmental impact	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
curiosity for a novel food	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Rate each of the following insect products based on your level of interest from 1-5.

	Not interested		↔	Very interested	
	1	2	3	4	5
Insect powder	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Whole insects (roasted)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Snacks (chips, cookies etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Protein bars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Insect burgers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pasta with insect flour	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. Have any of the suggested products sparked your interest enough to consider trying them?

- ☐ Yes
- ☐ No
- ☐ I am not sure

Appendix 2 - Raw data

What is your age?	What is your gender?	To what extent do health and sustainability play a role in your food choices?	Does eating insects seem disgusting to you?	Are you apprehensive about edible insects because it is a novel food?
13	Male	A little bit	No, but I won't try it	Maybe
13	Male	A little bit	No, but I won't try it	Maybe
15	Male	A little bit	A little bit	Definitely
20	Male	A little bit	No, but I won't try it	Probably
20	Female	A little bit	Not at all	No
21	Female	A little bit	A little bit	Probably
21	Male	Not at all	A little bit	No
21	Male	Not at all	A little bit	Probably
22	Male	A little bit	A little bit	Probably
24	Female	A little bit	A little bit	Maybe
24	Male	Very much	Definitely	Definitely
24	Female	A little bit	Definitely	Definitely
24	Male	A little bit	Not at all	Maybe
24	Female	A little bit	A little bit	Probably
24	Female	Very much	Definitely	Probably
25	Male	A little bit	Not at all	No
25	Male	A little bit	Not at all	Maybe
26	Male	Very much	A little bit	No
26	Male	Very much	A little bit	Maybe
26	Female	Very much	Definitely	No
27	Male	A little bit	A little bit	Maybe
28	Female	Very much	Definitely	Probably
28	Male	Very much	A little bit	Maybe
28	Female	Very much	A little bit	No
28	Female	A little bit	A little bit	Probably
29	Male	Very much	A little bit	No
29	Male	Very much	Not at all	Probably
30	Male	A little bit	No, but I won't try it	Definitely
32	Male	Very much	A little bit	Probably
32	Male	Very much	No, but I won't try it	No
32	Female	A little bit	A little bit	Definitely
33	Female	A little bit	Definitely	No
33	Female	A little bit	Definitely	Definitely
35	Female	Very much	Definitely	Maybe
35	Female	A little bit	Not at all	No
38	Female	A little bit	A little bit	Definitely
39	Female	A little bit	No, but I won't try it	No
39	Female	Very much	A little bit	Probably
39	Male	Very much	Definitely	Definitely
39	Female	A little bit	Definitely	Definitely
41	Male	A little bit	A little bit	Probably
42	Female	Very much	Not at all	No

43	Female	A little bit	No, but I won't try it	Probably
44	Female	A little bit	Definitely	Probably
46	Female	Very much	Not at all	Maybe
47	Female	Very much	No, but I won't try it	Probably
47	Female	A little bit	No, but I won't try it	Definitely
47	Female	Very much	Definitely	Definitely
50	Female	Very much	A little bit	Definitely
50	Female	A little bit	A little bit	Probably
50	Female	A little bit	A little bit	No
52	Male	Very much	A little bit	Definitely
52	Female	A little bit	Definitely	Probably
52	Male	A little bit	No, but I won't try it	Probably
52	Female	A little bit	A little bit	Probably
53	Female	A little bit	Not at all	No
53	Female	Very much	No, but I won't try it	Maybe
53	Male	A little bit	A little bit	Probably
53	Female	Very much	A little bit	Probably
54	Female	Very much	Definitely	Definitely
54	Male	A little bit	Not at all	Maybe
55	Female	Very much	A little bit	Probably
56	Female	Very much	A little bit	No
56	Female	Very much	Not at all	No
56	Male	Very much	No, but I won't try it	Probably
57	Male	A little bit	A little bit	Definitely
57	Male	A little bit	A little bit	Definitely
57	Female	A little bit	No, but I won't try it	Probably
57	Male	A little bit	Not at all	No
58	Female	A little bit	No, but I won't try it	Probably
58	Female	A little bit	No, but I won't try it	Probably
59	Male	Very much	Not at all	No
59	Male	Very much	No, but I won't try it	Probably
59	Male	A little bit	No, but I won't try it	Probably
60	Male	A little bit	Definitely	Probably
60	Female	A little bit	Definitely	Probably
60	Female	Very much	Definitely	Definitely
60	Female	A little bit	A little bit	Definitely
60	Female	Very much	A little bit	No
61	Female	Very much	Not at all	No
61	Male	A little bit	No, but I won't try it	Probably
62	Male	A little bit	A little bit	Probably
62	Female	A little bit	No, but I won't try it	Maybe
63	Male	Very much	Not at all	No
63	Female	Very much	A little bit	No
63	Female	A little bit	A little bit	No
63	Female	A little bit	Definitely	Definitely
64	Female	A little bit	Definitely	Definitely
64	Female	Very much	Not at all	No
64	Female	A little bit	Definitely	Probably
64	Female	A little bit	Definitely	Probably

64	Female	A little bit	Definitely	Probably
64	Female	A little bit	No, but I won't try it	Definitely
65	Female	A little bit	A little bit	Maybe
65	Female	A little bit	Definitely	No
65	Female	A little bit	Definitely	Definitely
-	Male	Very much	Definitely	-
-	Female	A little bit	Definitely	Probably
-	Male	Not at all	A little bit	Maybe
-	Female	A little bit	Not at all	Probably

Would you be more open to try insect-based foods if it were more easily available?	Are there any other reasons for you to reject insects as food?	If you can, please name your other reasons
Probably	I do not know	
Probably	I do not know	
Maybe	No	
Maybe	No	
Definitely	No	
Maybe	No	
Definitely	No	
Maybe	No	
Definitely	Yes	Het gaat er vooral voor mij om hoe het er uit ziet als het nog op een insect lijkt vind ik het er onsmakelijk uit zien ik vind dat het op een manier moet worden bewerk zoals gemalen of gefrituurd er goed uit te zien.
Probably	Yes	Vegetarisch
Maybe	No	
Maybe	No	
Probably	No	
Maybe	No	
No	No	
Probably	I do not know	
Probably	No	
No	Yes	Just the Idea insects are more likely to consume decaying organic matter instead of fresh organic matter
No	Yes	Veganistisch diet
No	Yes	Veganisme
Maybe	No	
No	Yes	I'm vegetarian. I view insects to be in between plants and animals. I don't have many moral objections to eating insects, but maybe I still have a few I'm scared it will not be hygienic to eat them. That there will be bacteria or viruses in them. (I think of flies touching everything)
Maybe	No	

Definitely	No	
No	No	
Probably	Yes	Vegetarian
Maybe	No	
No	Yes	Toch een soort creepy factor
No	Yes	Ik ben veganist, primair voor duurzaamheid, maar ook voor dierenwelzijn. Insectenwelzijn is me minder belangrijk dan koeienwelzijn, maar belangrijker dan plantenwelzijn.
No	Yes	Vegan lifestyle beter alternatief
Maybe	I do not know	
No	Yes	Veganisme
Probably	No	
No	Yes	Ik ben vegetarier
Maybe	Yes	Ik ben vegetariër en insecten vallen daar ook onder voor mij
Maybe	No	
No	Yes	Ik ben vegetariër, en insecten zijn ook dieren.
No	Yes	ik eet sowieso geen dierlijke producten
No	I do not know	
Probably	I do not know	
Probably	No	
Definitely	No	
No	No	
Maybe	No	
Definitely	No	
Maybe	I do not know	
Probably	No	
No	Yes	Geloof
Probably	No	
Probably	No	
Definitely	No	
Maybe	No	
No	Yes	Er zijn genoeg alternatieven
Probably	Yes	Verkrijgbaarheid
Probably	No	
Maybe	No	
Maybe	Yes	Het zijn levende wezens, is voor mij niet vegetarisch
Maybe	No	
Probably	No	
No	Yes	Vind het vies om insecten te eten en ga het ook niet proberen
Definitely	I do not know	
No	Yes	Maybe omdat ik het nooit gekend als een voedsel zit er ook hoe ok op gevoed ben
Maybe	No	
Probably	No	
Probably	I do not know	
Maybe	I do not know	
Maybe	I do not know	

Maybe	No	
Probably	No	
Probably	No	
No	No	
Definitely	No	
Maybe	I do not know	
No	I do not know	
Definitely	No	
Maybe	Yes	Vegetarier
No	No	
Probably	I do not know	
No	Yes	Ik eet helemaal geen dieren dus ook geen insecten. Maar ik vind insecten eten wel veel minder lijden en vervuiling met zich meebrengt dan het eten van zoogdieren . Dus in die zin ben ik er wel voor. Maar ik zou het zelf niet doen omdat ik dus vegetariër ben
Definitely	No	
No	No	
Probably	No	
Probably	Yes	Insecten in overvloed
Probably	No	
Probably	No	
Maybe	No	
No	No	
No	No	
Definitely	No	
No	No	
Probably	No	
Probably	No	
Maybe	I do not know	
Maybe	No	
No	Yes	De viezigheid van het insect
No	No	
No	Yes	Vegan
Maybe	I do not know	
Maybe	No	
Probably	No	

To what extent do the following aspects spark your interest for edible insects?		
[Nutritional benefits]	[Minimizing environmental impact]	[Curiosity for a novel food]
Quite interesting	Very compelling	Very compelling
Quite interesting	Very compelling	Very compelling
Quite interesting	Not really interesting	Quite interesting
Very compelling	Very compelling	Not really interesting
Very compelling	Very compelling	Very compelling
Quite interesting	Quite interesting	Very compelling

Rate each of the following insect products based on your level of interest from 1-5						Have any of the suggested products sparked your interest enough to consider trying them?
[Insect powder]	[Whole insects (roasted)]	[Snacks (chips, cookies etc.)]	[Protein bars]	[Insect burgers]	[Pasta with insect flour]	
4	3	3	3	3	4	Yes
4	3	3	3	3	4	Yes
2	1	3	3	2	3	Yes
3	3	3	3	3	3	No
2	5	5	3	3	3	Yes
1	3	4	3	2	3	I am not sure
2	4	5	2	3	2	Yes
4	2	3	3	3	4	No
4	3	4	4	4	4	Yes
4	1	4	4	1	3	No
5	1	4	4	3	5	Yes
2	1	2	3	1	3	Yes
3	3	4	4	2	2	Yes
3	2	5	5	5	4	Yes
1	1	2	2	2	2	No
4	4	2	5	4	4	Yes
1	3	3	1	3	3	I am not sure
1	1	1	1	1	1	No
2	2	2	2	2	2	No
1	1	1	1	1	1	No
1	1	3	4	3	4	I am not sure
2	1	3	2	2	1	No
1	1	3	4	4	4	I am not sure
5	1	4	5	4	5	I am not sure
1	1	2	2	1	1	I am not sure
4	1	4	4	2	4	Yes
4	3	4	5	4	4	Yes
2	1	3	2	2	3	Yes
2	1	2	2	2	2	No
2	1	1	2	1	2	No
2	1	1	1	2	2	I am not sure
1	1	1	1	1	1	No
3	3	4	4	2	4	Yes
2	1	3	3	3	3	No
2	1	2	3	2	3	No
4	5	1	1	2	2	I am not sure
1	1	1	1	1	1	No
1	1	1	1	1	1	No
1	1	1	1	1	1	No
3	4	4	4	4	2	Yes
3	2	4	4	4	4	I am not sure
3	3	5	5	5	3	Yes

1	2	1	1	1	1	No
1	1	1	1	1	1	I am not sure
5	3	4	4	4	5	Yes
3	1	1	2	1	1	I am not sure
3	3	3	3	3	3	Yes
1	1	1	1	1	1	No
3	1	4	3	4	4	Yes
1	2	3	3	2	3	Yes
1	1	3	4	5	5	Yes
2	1	4	4	4	1	I am not sure
1	1	1	1	1	1	No
3	2	3	4	3	4	Yes
4	2	2	2	2	4	Yes
1	4	4	4	1	1	Yes
1	1	1	1	1	1	No
1	2	4	1	2	3	I am not sure
1	4	4	3	2	4	Yes
1	1	1	1	1	1	No
4	5	5	5	5	3	Yes
3	1	1	1	1	1	No
5	3	4	4	3	5	Yes
1	5	5	5	5	1	Yes
4	4	4	4	4	4	I am not sure
3	2	2	2	2	2	No
3	2	2	2	2	2	No
1	2	2	3	2	2	I am not sure
4	2	5	5	5	5	I am not sure
3	3	3	3	1	3	Yes
3	2	3	2	1	2	No
5	5	5	5	5	5	Yes
3	1	3	4	2	3	I am not sure
1	1	1	1	1	1	No
4	1	4	1	2	4	Yes
3	1	2	4	1	2	No
1	1	1	1	1	1	No
4	1	3	2	1	3	I am not sure
1	1	1	1	1	1	No
1	5	5	5	5	1	Yes
1	1	1	2	1	1	No
1	3	5	4	3	3	I am not sure
4	2	1	3	3	4	Yes
4	5	4	3	4	4	Yes
1	2	2	2	2	2	Yes
1	2	3	2	3	3	Yes
1	1	1	1	1	1	No
3	5	5	5	5	5	No
5	2	5	4	5	2	Yes
1	1	1	1	1	1	No
2	1	2	2	1	1	I am not sure

2	1	2	2	1	1	I am not sure
3	2	3	4	1	5	Yes
2	3	2	3	2	3	I am not sure
1	1	1	1	1	1	No
1	1	1	1	1	1	No
1	1	1	1	1	1	No
2	1	2	2	1	2	No
1	3	3	3	3	4	Yes
1	4	5	5	1	3	Yes
2,32 (mean)	2,06 (mean)	2,76 (mean)	2,74 (mean)	2,34 (mean)	2,6 (mean)	

Following tables are a summary of the quantitative results per question (from the questionnaire):

1. What is your age?

Age range	Count
(blank)	4
13-25	17
26-38	19
39-51	15
52-65	45
Grand Total	100

2. What is your gender?

Gender	Count
Female	61
Male	39
Grand Total	100

3. To what extent do health and sustainability play a role in your food choices? To what extent do health and sustainability play a role in your food choices?

Answer	Count
A little bit	60
Not at all	3
Very much	37
Grand Total	100

4. Does eating insects seem disgusting to you?

Answer	Count
A little bit	37
Definitely	26
No, but won't try it	20
Not at all	17
Grand Total	100

5. Are you apprehensive about edible insects because it is a novel food?

Answer	Count
Definitely	22
Maybe	15
No	25
Probably	37
(blank)	
Grand Total	99

6. Would you be more open to try insect-based foods if it were more easily available?

Answer	Count
Definitely	12
Maybe	30
No	30
Probably	28
Grand Total	100

7. Are there any other reasons for you to reject insects as food?

Answer	Count
I do not know	16
No	58
Yes	26
Grand Total	100

8. To what extent do the following aspects spark your interest for edible insects?

Answer	Nutritional benefits	Minimizing environmental impact	Curiosity for a novel food
Not really interesting	13	17	46
Quite interesting	51	30	35
Very compelling	36	53	19
Grand Total	100	100	100

9. Rate each of the following insect products based on your level of interest from 1-5.

Rating	Insect powder	Whole insects (roasted)	Snacks (chips, cookies etc.)	Protein bars	Insect burgers	Pasta with insect flour
1 (no interest)	40	49	27	26	37	31
2	17	19	17	20	24	17
3	20	17	22	20	17	22
4	17	7	21	22	12	21
5 (high interest)	6	8	13	12	10	9
Grand Total	100	100	100	100	100	100

10. Have any of the suggested products sparked your interest enough to consider trying them?

Answer	Count
I am not sure	22
No	37
Yes	41
Grand Total	100

The following are the raw data from the qualitative research (interviews):

Heb je wel eens insecten gegeten?	Zijn jouw gevoelens over het eten van insecten:	Hoe zou je deze gevoelens omschrijven?
Nee	Positief	Griezilig, maar ook beetje nieuwsgierig
Nee	Positief	Vind het apart maar ben nieuwsgierig
Ja	Positief	nieuwsgierig
Nee	Positief	in 1ste instantie terughoudend, maar moet het misschien eens proberen
Ja	Positief	ik ben verrast van het gehalte aan eiwitten in deze producten
Nee	Positief	wil het wel gaan doen als het een oplossing is voor al het leed in de vleesindustrie
Ja	Positief	nieuwsgierig, sta er open voor
Ja	Positief	wel oké, we eten ook garnalen en slakken
Nee	Neutraal	Bereid om te leren eten
Ja	Neutraal	Nieuwsgierig maar afhankelijk van hoe gemaakt en verwerkt
Nee	Neutraal	ergens in verwerkt wil ik proberen, maar niet als het zichtbaar is, toch eng
Ja	Neutraal	iedereen moet eten wat hij lekker vindt. Ik zou het niet zomaar eten, maar misschien wel als het ergens in verwerkt is zodat ik het niet herken
Ja	Neutraal	ik weet dat ze gezond zijn. Ik zou eraan kunnen wennen.
Nee	Neutraal	een beetje eng, maar als het er niet uit ziet als een insect dan niet eng
Ja	Neutraal	ik vond het een beetje vies
Ja	Neutraal	nieuwsgierig, maar afhankelijk van hoe gemaakt en verwerkt
Nee	Neutraal	beetje eng, wil het wel leren eten
Ja	Neutraal	Het eten van insecten is onbekend we moeten nog aan het idee wennen.
Nee	Neutraal	Ik vond het leuk om te proberen (meerdere malen), maar vond het niet bijzonder lekker.
Nee	Neutraal	Wat de boer niet kent eet hij niet
Nee	Neutraal	ik zou geen zichtbare insecten willen eten, misschien wel verwerkt in een gerecht. van een insect zo opeten krijg ik echt de kriebels
Nee	Neutraal	Ik zou het zelf niet snel eten, maar zie wel de voordelen ervan.
Nee	Neutraal	aarzelend, wil de oorspronkelijke vorm niet herkennen
Nee	Neutraal	wil ze niet herkennen, wel eten

Nee	Neutraal	vreemd, nu ook insectenindustrie?	
Nee	Neutraal	past niet in onze cultuur	
Nee	Negatief	Niet mee opgegroeid, eet geen vlees, maar zou dan liever dat eten dan insecten	
Nee	Negatief	afkeer	
Nee	Negatief	naar gevoel in mijn maag	
Nee	Negatief	maag keert om	
Nee	Negatief	is niet voor mensen, dan liever kweekvlees of vleesvervanger	
Nee	Negatief	krijg er rillingen van	
Nee	Negatief	overgeef gevoel	
Nee	Negatief	maag gaat rommelen	
Nee	Negatief	Eng	
Nee	Negatief	Ik griezel ervan als ik er aan denk	
Nee	Negatief	Misschien als ik uitgehongerd ben. Het is meer het idee, niet smaakvol, wat tegenstaat. Als je het van tevoren niet weet, eet je ze anders	
Nee	Negatief	Het idee is niet aantrekkelijk, als je het van tevoren niet weet dat je ze eet, dan zou ik het doen	
Nee	Negatief	Lijkt me niet lekker	
Nee	Negatief	Staat me tegen de vorm en Die pootjes brrr	
Nee	Negatief	Insecten zijn ook dieren en ik eet geen dieren. Grootse productie van insecten is misschien iets maar niet veel beter dan de huidige bio-industrie.	
Nee	Negatief	Insecten zijn in mijn ogen een goede vervanging van vlees en vis producten, maar voor mij als vegan niet gewenst als optie.	
Nee	Negatief	moet er niet aan denken	
Nee	Negatief	Afschuw gevoelsmatig, maar rationeel wel positief	