



The Impact of Familiarity on Consumer Acceptance of Entomophagy: a Cross- Cultural Study of Mexico and Portugal

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ABSTRACT

The environmental impact of mainstream protein sources, such as meat, has driven the need for food innovation. Edible insects have emerged as a novel, sustainable, and nutritious alternative, offering a rich source of protein and essential amino acids while producing significantly lower carbon emissions and requiring less water during production. Despite these benefits, acceptance of edible insects remains low in many Western countries, contrasting sharply with higher acceptance in regions where entomophagy has been a long-standing tradition. This research seeks to explore the factors influencing acceptance of insect-based foods and how these factors differ between countries with and without a cultural history of entomophagy, focusing on Portugal and Mexico.

The dissertation used exclusively quantitative methods, with data being collected through an online survey. The study populations were Portuguese and Mexican adults. Data was analysed using descriptives, frequencies, correlations and linear regression models. Results showed that nationality played a role in shaping familiarity with insect-based foods, with familiarity being higher in Mexico than Portugal. Increased familiarity, in turn, was associated with lower disgust towards insects and higher acceptance of entomophagy. There were also important gender differences, with males exhibiting lower disgust towards insects and higher acceptance of entomophagy than females in both countries. Also, lower food neophobia was linked to greater acceptance of insect-based foods. Finally, both Mexican and Portuguese consumers shared a preference for stealth over direct entomophagy, highlighting that the conspicuous integration of edible insects in foods is less appreciated than their use as processed ingredients.

Keywords: entomophagy, familiarity, insect disgust, food neophobia, linear regression models, Portugal, Mexico, sociodemographic patterns

Title of the dissertation: “The Impact of Familiarity on Consumer Acceptance of Entomophagy: A Cross-Cultural Study of Mexico and Portugal”

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RESUMO

O impacto ambiental das fontes tradicionais de proteína, tem impulsionado a necessidade de inovação alimentar. Os insetos comestíveis emergiram como uma alternativa nova, sustentável e nutritiva, oferecendo uma rica fonte de proteína e aminoácidos essenciais, enquanto produzem significativamente menos emissões de carbono e requerem menos água durante a produção. Apesar desses benefícios, a aceitação de insetos comestíveis permanece baixa em muitos países ocidentais, contrastando fortemente com a maior aceitação em regiões onde a entomofagia é uma tradição consolidada. Esta pesquisa busca explorar os fatores que influenciam a aceitação de alimentos à base de insetos e como esses fatores diferem entre países com e sem uma história cultural de entomofagia, com foco em Portugal e México.

A dissertação utilizou métodos quantitativos, com dados coletados por pesquisa online. As populações estudadas consistiram em adultos. Os dados foram analisados utilizando estatísticas descritivas, frequências, correlações e modelos de regressão linear. Os resultados mostraram que a nacionalidade desempenhou um papel na familiaridade com alimentos à base de insetos, maior no México que em Portugal. Maior familiaridade foi associada a menor aversão a insetos e maior aceitação da entomofagia. Também foram observadas diferenças de gênero, com homens apresentando menor aversão a insetos e maior aceitação da entomofagia em ambos os países. Além disso, menor neofobia alimentar foi ligada a maior aceitação de alimentos à base de insetos. Por fim, consumidores demonstraram preferência por formas discretas de consumo, destacando que a integração visível de insetos nos alimentos é menos apreciada que seu uso como ingredientes processados.

Palavras-chave: entomofagia, familiaridade, repulsa a insetos, neofobia alimentar, modelos de regressão linear, Portugal, México, padrões sociodemográfico

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Writing this dissertation meant a lot to me. Firstly, because I got to be in touch with my country Mexico, which I deeply miss, by exploring the culture of our food and identity. Secondly, because I got to learn more from the country I have grown very fond of after over a year of living here, Portugal. This research was designed to explore and contrast the perspectives of two cultural contexts that are deeply significant to me, focusing on a subject I have always found fascinating, entomophagy. This within a context I am deeply passionate about which is health and sustainability.

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CHAPTER 1: INTRODUCTION

This Chapter comprises a short introduction to the sustainability and health benefits of entomophagy and briefly describes the role of entomophagy in Mexico and Portugal. Furthermore, it provides an overview of the methodology and the outline of chapters to come. Lastly, it offers practical examples of how this research can be applied, highlighting its contributions to both academia and practice.

1.1 Background and Problem Statement

As the world's population continues to rise, so does the demand for food, particularly farm animal protein. This raises sustainability concerns due to high water usage, deforestation, and greenhouse gas emissions (Prochazka et al., 2024). Alternative protein sources, such as insects, grains, and legumes, offer a more sustainable way to meet food demands than meat due to their significantly lower environmental impact. Namely, producing one gram of beef protein requires 254 m² of land, while the same amount of insect protein requires only 18 m² (Shahbandeh, 2024). Insects not only help reduce the environmental footprint of food and feed production, but are also a highly nutritious source of protein, being rich in healthy fats, amino acids, and minerals, with their use also decreasing the need for pesticides (Tang et al., 2019).

The idea of entomophagy, the practice of eating insects by humans, started to be explored in Western cultures in 2013 and gained more popularity by 2019. However, factors like disgust, lack of familiarity and neophobia have slowed the acceptance of this protein source (Kröger et al., 2022). In Europe, for instance, only 10% of consumers are willing to accept entomophagy (European Consumer Organization, 2020, as cited by Khatsenkova et al., 2023), while in North America this proportion is higher, representing 33% of the population (Reed et al., 2021). Despite consumer resistance, and in the hope of addressing the growing eco-friendly food demand, several start-up companies emerged that are dedicated to the production of insect protein foods. Examples are *SENS Food*, that creates products from cricket powder, or *Divaks*, which uses yellow mealworms as a protein option (Shenoy, 2024). However, these companies have yet to identify which national markets to tackle, which consumer segments to target and which communications strategies will succeed in persuading Western consumers to adopt insect protein in their diets.

Several studies have shown that consumers are more likely to accept insect-based foods when entomophagy is already part of their country's food tradition, rendering it more familiar (Kröger

et al., 2022). This effect of familiarity does not necessarily need to be linked to previous first-hand exposure to the product: the mere knowledge of entomophagy has been shown to have a positive correlation with its acceptance (Kröger et al., 2022). Based on this, one can hypothesize that markets where entomophagy has been historically present will be more willing to adopt entomophagy than those where the concept is unheard of or taboo. Two countries that exemplify this dichotomy are Mexico and Portugal.

Insects have been part of Mexican diet since pre-Hispanic times, due to the high variety of species available in the country. So far, as much as 549 edible kinds of insects have been identified in Mexican territory (Gobierno de México, 2018). Historically, colonizers campaigned against the practice of entomophagy in the country, despite their fascination with the concept and having written several pieces highlighting the use of insects as a main ingredient in recipes (Garrido, 2023). These efforts led many regions to discontinue the practice in favour of the introduction of chicken, beef, and pork as a source of protein; these animals were not present in the region prior to colonization (Robinson, 2021). Nevertheless, the practice of entomophagy is present in Mexico still today. The main regions in the country where insects are consumed are the south, southeast, and centre, where mexicans eat *chapulines* (grasshoppers), *gusanos de maguey* (maguey worms), *jumiles* (stink bugs), and *escamoles* (ant larvae), among others. Nevertheless, such foods are known as “pre-Hispanic delicacies” and are considered somewhat exotic at the present (Gobierno de México, 2018). Contrastingly, insects as sources of food for humans remains rather unfamiliar in most of the Western world, including Portugal, being a challenging market for food startups to enter. The Portuguese diet or the “Atlantic diet” consists mainly of fresh fish, meats, olive oil and seasonal vegetables and has no heritage of insects as a source of protein (McCarthy, 2024).

1.2 Aim and Scope

The main aim of this dissertation is to determine to what extent familiarity plays a role in the acceptance of insects as a substitute for farm animal protein in the Mexican and Portuguese consumer markets. In addition, it seeks to identify other key determinants of acceptance in each market, allowing for their cross-cultural comparison between the two countries. To meet this goal, the following research questions were formulated:

RQ1: Do consumers differ in their acceptance of entomophagy based on different levels of familiarity?

RQ2: What are the key cultural and psychographic factors that impact the acceptance of entomophagy in Mexico and Portugal, and how do these factors compare cross-culturally?

This dissertation does not address the technical or marketing development of new insect-based food products nor explores the nutritional or environmental benefits of insect protein in depth. It also does not cover economic or policy issues, or marketing communication strategies for introducing insects as food to consumers. It also does not address international insect consumption trends, beyond Mexico and Portugal, or explore other alternative food sources, such as plant-based or lab-grown proteins. Furthermore, it does not evaluate the impact of familiarity on the acceptance of other products, nor explores the impact of familiarity on other marketing aspects such as user experience, advertising, pricing or quality perceptions.

1.3 Research Methods

To answer the proposed research questions, a descriptive research design was employed with a mono-method quantitative approach. Primary data was collected through a self-administered online survey. The study followed a fundamental research approach as it aimed to test a theory through a hypothesis, utilizing a deduction method (Saunders et al., 2019). Survey respondents were selected based on their nationality and presented with a dedicated version of the survey, i.e., questions were the same for both nationalities, but language changed accordingly. The total sample size was 158 valid responses in Mexico and 121 in Portugal. Response formats were mostly close-ended multiple choice, namely for inquiring about familiarity with entomophagy and demographics, and 7-point Likert type scales to measure attitudes and willingness to accept. The survey was programmed and distributed with Qualtrics Software, and IBM SPSS Statistics version 2.8 was used for data analysis.

1.4 Relevance

As startups promoting entomophagy emerge due to sustainable trends, understanding the market is crucial. These companies can benefit from the findings here presented by understanding better how to tailor their marketing approaches more effectively to the Portuguese and Mexican market. In particular, this dissertation provides valuable insights to help culturally understand the market, allowing companies to tailor marketing strategies to regions where insect consumption is either established or novel. Furthermore, it provides a

greater understanding of the attitudes and lifestyles of those consumers more prone to accept entomophagy, which may also aid in the development of marketing tactics. This dissertation also assesses market awareness of entomophagy, enabling companies to evaluate if and how educational campaigns could effectively promote their products. Lastly, it offers information as to which products are more likely to be accepted by the market and thus aids in product development.

Regarding academic contributions, this study enhances understanding of the impact of familiarity on the acceptance of novel and sustainable products, specifically edible insects. The study of entomophagy is relevant because of its power to promote sustainability while also presenting the challenge of respecting cultural and individual dietary preferences (Van Huis, 2014). Finally, the concept of familiarity is important in marketing research since it promotes credibility and trustworthiness between the product and consumer (Carazan, 2023). In addition, this dissertation contributes to the field of cross-cultural studies, ultimately helping in the development of effective strategies for promoting sustainable food sources globally.

CHAPTER 2: LITERATURE REVIEW

This chapter reviews extant studies on consumer acceptance of entomophagy, focusing on the impact of familiarity. It also examines existing research on consumer behaviour toward novel foods. Additionally, it assesses the theoretical framework of familiarity in product marketing. Cultural studies of entomophagy, especially those studying Mexico and Portugal, are reviewed to understand differences in food consumptions, factors influencing familiarity and consumer acceptance by identifying barriers and facilitators. Finally, this review identifies research gaps and proposes future directions for research.

2.1 Global Trends in Food and Sustainability

Global food trends changed dramatically in recent years in response to the environmental pressures felt by the agri-food system, which is responsible for one-third of all greenhouse gas emissions worldwide. To address this, the UN 2030 Agenda for Sustainable Development set out to create sustainable food systems that also mitigate hunger and malnutrition (Martin & Vos, 2024). Many novel food sources are being explored that could contribute to increase the sustainability of agri-food systems, such as insects and algae (as food or feed), lab-grown meat and edible jellyfish, among others (Siddiqui et al., 2022). In particular, interest for insects as food, i.e., entomophagy, is growing globally, including in regions with little or no tradition of consuming insects, such as Europe or North-America (Tzompa-Sosa et al., 2023).

Modern entomophagy has risen in the West in response to research conducted in the last two decades shedding new light onto the economic, ecological, and animal/human health benefits offered by insects (Kröger et al., 2022). Insects are very cheap to produce or can be caught in their own environment, being sold at very high prices. This means that no high capital is needed to start their production. This practice can create employment and represent income for underdeveloped communities and regions (Tang et al., 2019). Furthermore, insects have low carbon emission, require minimal water to grow and reduce the need for chemical pesticide. Importantly, edible insects are composed of 40-75% of crude protein and 8-70% of fats in dry weight, being a source of micronutrients and amino acids (Tang et al., 2019). To take full advantage of all these benefits, modern entomophagy explores three different uses of insects in agri-food systems: direct, where whole, unprocessed insects are consumed by humans; indirect, where insects are used as animal feed and humans consume the animals that have been fed insects; and entomophagy by stealth, where insects are processed into ingredients that are not visible in the final food product (Dagevos & Taufik, 2023).

2.2 Understanding Familiarity

Familiarity refers to a memory phenomenon in which something is recognized as being encountered before, even if no specific details of the initial experience are recalled (Voss & Paller, 2008). It represents the cognitive ability to apply knowledge gained from past experiences with objects or stimuli. This recognition is based on observable characteristics and mental frameworks, or schemas, that help define, recognize, and understand the object. Human cognition uses these mental shortcuts, or schemas, to quickly access information and match an object or concept for identification (Aldridge et al., 2008). Schemas are crucial because they shape attitudes or opinions, whether positive or negative. Once an attitude or belief is formed, it becomes difficult to change, even when new information is provided (Fischer & Frewer, 2009).

Familiarity is a personal experience shaped by cultural context, where both cultural and individual experiences play a significant role (Tan et al., 2015). Familiarity can be direct, through personal use of a product, or indirect, by simply knowing about it (Dangelico et al., 2024). In the context of entomophagy, familiarity can therefore be categorized into two types: familiarity with the concept of entomophagy (indirect) and familiarity with the sensory experience of consuming insects or insect-based products (direct), meaning prior consumption. Individuals find comfort in familiarity because it brings a sense of knowing and recognition, which helps them feel more at ease and secure (Aldridge et al., 2008). Both familiarity and previous consumption have shown to have a positive impact on acceptance of insects or insect-based food (Kröger et al., 2022).

To achieve familiarity, exposure is necessary, with repeated exposure enhancing the experience of familiarity (Aldridge et al., 2008). The “Mere Exposure Effect”, a psychological theory proposed by Robert Zajonc, suggests that increased exposure to a stimulus leads to greater likability of that same stimulus (Hopper, 2019). In other words, the more frequently someone encounters or is exposed to something, the more positive their feelings toward it tend to become. In this sense, familiarity is a precursor of liking and acceptance.

2.3 Barriers and Motivators in Entomophagy

Insects have been historically harvested by humans in the tropical regions of Africa, Asia and America due to its climate conditions. Individuals in these regions have thus been consuming insects for centuries or even millennia, unlike those in Europe and North-America, where there is no historical evidence of the practice of entomophagy (Van Huis, 2017). Research has shown that countries with a higher diversity of insect species tend to have greater acceptance of insect

consumption compared to countries with fewer insect species (Tzompa-Sosa et al., 2023). Many factors such as demographics, attitudes and individual and cultural experience may affect willingness to try and intention to accept entomophagy. When studying entomophagy, it is essential to differentiate between the factors that promote initial motivation to try it and those that influence repeated consumption (Tan & House, 2018). Willingness to try refers to the intention to taste a product, while actual tasting relates to a past experience. Adoption, on the other hand, involves integrating the product into one's regular diet (Tzompa-Sosa et al., 2023; Tan et al., 2015).

Several studies demonstrate that feelings of disgust (anticipated or experienced) are the lead cause for the rejection of entomophagy in Western consumer markets (Kröger et al., 2022; Ribeiro et al., 2022). Moreover, food neophobia, i.e., the reluctance or fear to try new foods (Siddiqui et al., 2022), has been shown to have also a significant negative impact on the acceptance of insect-based foods (Kröger et al., 2022). Gender, on the other hand, is an important indicator of acceptance since the majority of research shows that males are more prone to accept insects as food than females (Kröger et al., 2022; Ribeiro et al., 2022; Castro & Chambers, 2018). Regarding age, most research concludes that younger generations have a greater openness to entomophagy than older individuals. This finding is reported in both traditional and nontraditional insect eating countries (Tzompa-Sosa et al., 2023; Castro & Chambers, 2018). Finally, Kröger et al. (2022) concluded that occupation and education achieved were generally not associated with acceptance of entomophagy. Young men with a low feeling of disgust towards entomophagy could thus make up the most promising consumer segment for insect-based foods, as they typically exhibit low food neophobia and seek to try new products due to a high sense of adventure and curiosity (Siddiqui et al., 2022). Indeed, consumers pursuing new food experiences exhibit a higher willingness of acceptance insect-based foods than their counterparts (Ribeiro et al., 2022). Finally, research is consistent with the finding that entomophagy by stealth has a higher acceptance than direct or indirect entomophagy (Tzompa-Sosa et al., 2023; Ribeiro et al., 2022; Kröger et al., 2022).

2.3.1 Insect Disgust

Feelings of disgust cause unwillingness to try insect-based foods, while their absence or weakness is associated with a higher purchase intention for these products (Dagevos & Taufik, 2023). Disgust towards insects is not rooted in a phobia, but rather in a socio-cultural negative emotion the individual experiences with the thought of arthropods as food (Ribeiro et al., 2022).

Insect disgust is more prevalent in Western countries than in other geographies, largely due to the perception that invertebrates can be perceived as unhygienic and be potential carriers of disease (Castro & Chambers, 2018). A strategy to break this barrier is to expose consumers to edible insects or the insect-based foods and encourage them to try these products and experience their sensory characteristics. If the sensory expectations of the product turn out to be either matched or exceeded, consumers are more likely to overcome their feelings of disgust and become more willing to adopt insect-based foods as a whole (Delgado et al., 2020).

2.3.2 Food Neophobia

There have been many food trends that have surged from changes in behaviours, patterns and taste preferences. Novel convenience food, for instance, has surged as a necessity for a fast-paced lifestyle (Beaton, 2024). Food-neophobic individuals are those very cautious and selective when choosing or incorporating food into their diets (Siddiqui et al., 2022). Different factors can affect an individual's relationship to food and can decrease neophobia, like being exposed to a variety of foods from a young age, travel habits (since exposure to a variety of food is greater), living in urban cities (due to higher exposure to different foods) and enlarging an individual's nutritional knowledge (Siddiqui et al., 2022). Food neophobia varies from one country to another and is influenced by the cultural, social, and environmental contexts of a particular demographic group (Siddiqui et al., 2022).

2.3.3 Familiarity with Food and Entomophagy

Research has shown that direct and indirect familiarity with entomophagy positively influences its acceptance (Kröger et al., 2022), so that high familiarity aligns with a higher willingness to try insects or insect-based foods (Tan et al., 2015). On the contrary, unfamiliar foods are mostly rejected since they are associated with higher risks. Meanwhile, familiar foods are perceived to have more benefits (Fischer & Frewer, 2009). Moreover, the context in which a food is presented is very important since it may define what is familiar or not. This is because context can aid in forming familiarity schemas (Aldridge et al., 2008).

Consumers often tend to choose the same foods as their peers. This points out to the importance of observational learning in food purchases, especially in unfamiliar contexts (Edenbrandt et al., 2020). A study on consumer familiarity with food found that consumers spend a longer time evaluating information about unfamiliar than familiar food (Fischer & Frewer, 2009). The information presented first was the one that shaped perception the most. Previous associations,

however, were still more influential (Fischer & Frewer, 2009). In the context of entomophagy, the evaluations of consumers with no direct familiarity are based on visual features and categorical associations. In the case of whole edible insects, these associations are mainly negative, being determined by cognitive disgust. Meanwhile, consumers with direct familiarity evaluate the insect eating experience based on the memories of the sensory properties of insects previously tried (Tan et al., 2015).

2.4 Cross-cultural Comparisons

2.4.1 Portugal

Research consistently shows that Southern European countries exhibit low acceptance of entomophagy due to their stronger food culture, slow changing food scene and narrower international cuisine exposure, compared to their Northern neighbours (Tzompa-Sosa et al., 2023; Verneau et al., 2016). In line with this, acceptance of insect-based products in Portugal is likely lower than in other Northern European countries. One survey seeking to compare the acceptance of entomophagy in Portugal and Norway showed that acceptance was lower for Portuguese consumers (Ribeiro et al., 2022). The most significant factor driving rejection of entomophagy in Portugal was disgust, followed by food neophobia. Rejection was highest for direct entomophagy followed by stealth entomophagy (Ribeiro et al., 2022). The type of entomophagy which had the highest acceptance was thus indirect (insect-based feed), irrespectively of the farm animal that would be fed with the insect protein.

In terms of legislation, the production and marketing of insects as food (direct & stealth entomophagy) in Portugal is governed by the European Novel Food Regulation. This regulation covers all foods that had not been significantly consumed by humans within the EU before May 15, 1997. The first insect species to be authorized under this legislation was the yellow mealworm, which gained approval in 2021. Since then, additional insect species, such as the house cricket, have also been authorized or continually reviewed (IPIFF, 2024).

2.4.2 Mexico

Research has shown that acceptance of entomophagy in Mexico is high, surpassing even countries with similar historical tradition of insect consumption. Castro & Chambers (2018) conducted a survey on the practice of entomophagy in 13 countries across five continents and found that consumers in Mexico were the most likely to try insect-based foods. Namely, 71% of them were willing to consume insects as foods, against only 56% in Thailand, for instance,

a country known for its insect-eating practices. Likewise, Mexico exhibits a higher consumer acceptance towards mealworms as food than China (Tzompa-Sosa et al., 2023), even if both countries have one of the highest diversity of edible insect species worldwide (Carreño, 2020). Research highlights that the macro-region within Mexico also plays a significant role in predicting the acceptance of entomophagy (Tzompa-Sosa et al., 2023; Castro & Chambers, 2018). The south and south-east of the country seem to have the lowest rejection (14%) to entomophagy, followed by the centre of the country (17%) and lastly the north, which has the highest rejection (25%) (Tzompa-Sosa et al., 2023). Low rejection of entomophagy in Mexico, particularly in the south and south-east of the territory is likely due to insects being deeply rooted in the culinary traditions and food culture of the country (Carreño, 2020; Hurd et al., 2019).

Qualitative research has shown that Mexicans living abroad continue to consume edible insects despite having animal-based protein sources available to them (Hurd et al., 2019). This signals that this food is part of the nation's cultural identity. Insects have been a delicacy in Mexican cuisine for a long time, being found in sauces, toppings, spices and main courses. In Oaxaca, a southern state of the country, insects are even sold in meat markets. This indicates how much they are perceived in equal terms to meat as a source of protein, playing a very important part in the region's nutritional resources and economy for a long time (Hurd et al., 2019).

Mexico lacks legislation regulating any insect species, and COFEPRIS (Comisión Federal para la Protección contra Riesgos Sanitarios), the agency responsible for such regulations, has not yet established any laws (Carreño, 2020). This absence of regulation makes exports challenging and poses significant health risks, as insects can trigger allergies, particularly those that are not well-studied, or may be cross-infected (Carreño, 2020; Tang et al., 2019).

2.5 Marketing of Entomophagy

The marketing of insects as food in the Western World has been referred to as “impossible” (Van Huis, 2017). However, several studies provide relevant information about what messages and consumption contexts might be the most suitable to market these foods. Willingness to try edible insects or derived foods is an important driver of consumer adoption (Tzompa-Sosa et al., 2023). When it comes to actual tastings, having a positive first experience with the product is crucial for later adoption, as the subjective perception of the tastiness of the product plays a crucial role (Van Huis, 2017). If from the start the food fails to meet expectations in terms of taste and perceived benefits, adoption becomes unlikely (Tan et al., 2015; Aldridge et al., 2008).

Marketing communications and educational activities about the benefits of edible insects as alternative protein for human diets may facilitate the acceptance of stealth entomophagy by Western consumers. An experimental study conducted in Italy and Denmark found that messages emphasizing individual (nutrition/health) and societal (sustainability/environment) benefits had a significant positive effect on willingness to try edible insect foods, with societal benefits having a longer-lasting impact than individual ones (Verneau et al., 2016). Although information about the environmental or health benefits of insects may enhance the willingness to try them, it alone is likely insufficient to change consumer choices, especially in more resistant segments (Dagevos & Taufik, 2023; Tan et al., 2015). Vegan consumers, for instance, largely oppose entomophagy, and a vegetarian diet does not encourage insect consumption, making messages focused on these groups likely ineffective (Kröger et al., 2022). A lack of assurance that the product is safe for consumers, may likewise cause distress, particularly in neophobic consumers. It is thus crucial that communication is transparent and provides accurate and adequate information about edible insect foods (Siddiqui et al., 2022). A message promoting the acceptance of entomophagy delivered by a well-known or influential person can have a positive impact on the adoption of entomophagy beyond the value of information alone (Siddiqui et al., 2022). In contrast, a message purely based on the practical benefits of entomophagy, but without a social figure to endorse it, will have a lesser impact.

Familiarity strongly influences and thus predicts consumers' purchase intentions regarding insect-based foods. Consequently, marketing strategies like free tastings, promotions, clear advertising, and informative labelling should be developed to boost familiarity with entomophagy and shift consumer behaviour towards higher acceptance and adoption (Dangelico et al., 2024). However, a positive product experience alone might still be insufficient to persuade consumers; factors like availability, pricing strategies, and product knowledge must also be further explored (Van Huis, 2017). Since entomophagy by stealth is the most accepted practice, products where insects are not visibly detectable are likely to have the highest acceptance (Dagevos & Taufik, 2023). Moreover, it is advisable that novel insect products are launched under separate brands in the case of established brands. Research shows that the more disgust a consumer feels toward insects, the more likely they are to stop buying from a brand that also markets insect-based products, for fear of contagion (Castro & Chambers, 2018). To protect brand equity, the best strategy is to not use existing brands to market them.

2.6 Conclusion and Research Hypothesis

This literature review revealed that entomophagy is a promising avenue for the future of global agri-food systems by being a driver of sustainability, due to its low cost, high nutritional value and low ecological impact (Tang et al., 2019). But despite the ecological and nutritional benefits of insects as a food source, consumer resistance to insect-based foods in Europe is high, mainly due to psychological barriers such as disgust and food neophobia (Ribeiro et al., 2022). As a result, the introduction of insect-based products is not yet happening in mainstream retailers and thus understanding the concept in a practical way is difficult. Consumer behaviour studies should address the practical challenges of introducing insect-based products in retail settings. To compound the problem further, research on the consumer acceptance and adoption of entomophagy is still scarce, because these phenomena have only been studied for little over a decade (Kröger et al., 2022). Namely, there is a research gap on the psychological barriers and drivers related to entomophagy in Western countries (Verneau et al., 2016). There is also a notable lack of research in countries where insect eating is normalized (Tzompa-Sosa et al., 2023). This is evident in Mexico, where the practice of entomophagy is deeply rooted and could offer valuable insights. Yet here, research has primarily focused on cultural perspectives rather than on individual attitudinal drivers that promote consumption in the region. More studies are needed that investigate the psychological barriers and drivers influencing acceptance of insect-based products.

Cross-cultural research to explore similarities in perceptions and acceptance of insects as food requires further investment as well (Tan et al., 2015). This literature review showed that there is no cross-cultural research comparing the practice of entomophagy between Mexico and Portugal. Indeed, there has been little focus on why this food is popular in entomophagy-rich countries like Mexico, even though understanding these preferences could greatly enhance efforts to promote it in non-insect-eating countries (Tan et al., 2015). Cross-cultural comparisons between countries with normalized insect consumption are likewise needed to explore similarities and differences in perceptions and attitudes. Meanwhile, research in entomophagy-practising countries should investigate individual attitudinal drivers that promote consumption alongside culture, since studies have shown the need to consider both psychological and product factors driving acceptance, as well as the social and contextual context (Tan & House, 2018).

Importantly for the goals of this dissertation, the review of literature highlighted that familiarity is a key determinant in the acceptance of entomophagy (Kröger et al., 2022). Given that greater

familiarity can lead to increased acceptance of entomophagy (Tan et al., 2015), the first research hypothesis states:

H1: Familiarity with entomophagy is positively associated with acceptance of insect-based foods

Regarding nationality, in Mexico, insect consumption is deeply rooted in the culture (Tzompasosa et al., 2023; Castro & Chambers, 2018), whereas in Portugal it is not. Consequently, the second research hypothesis to be proposed is:

H2A: Consumers in Mexico are more familiar with entomophagy than consumers in Portugal, being also more likely to accept insect-based foods (H2B)

The review further emphasized the pivotal role of attitudes and psychographics, particularly disgust and neophobia, in influencing the acceptance of entomophagy (Kröger et al., 2022), thus the third and fourth research hypothesis read as follows:

H3: Insect disgust is negatively associated with willingness to accept insect-based foods

H4: Food neophobia is negatively associated with willingness to accept insect-based foods

Additionally, psychographics may vary by country, those with a history of entomophagy have shown lower levels of disgust, while countries without this heritage have scored higher levels (Castro & Chambers, 2018; Siddiqui et al., 2022), thus, the fifth and final research hypothesis is formulated as follows:

H5: Consumers in Mexico have lower insect disgust than consumers in Portugal

Table 1 summarizes the findings of the literature review. The next chapter presents the research methodology used for data collection and analysis, in order to test the research hypothesis.

Table 1. Overview of Literature Review Findings.

	Acceptance	Familiarity	Disgust	Neophobia	Drivers of Acceptance	Regulation
Mexico	High with 71.4% willing to try. Acceptance higher than other countries with entomophagy tradition like China and Thailand.	Entomphagy deeply rooted in Mexican gastronomy and culture.			Masculinity, younger generations and entomophagy by stealth have a positive influence. Macro-region is an important demographic for acceptance.	No current regulation regarding production, commercialization or exports. Health risks due to no regulation.
Portugal	Lower acceptance than other European countries due to strong food traditions.		Main driver of rejection in the country. In Western cultures, insect disgust is common due to perceptions of invertebrates as unhygienic or disease carriers.		Preference for stealth entomophagy and for functional products (such as protein shakes).	Regulated by the European Novel Food Regulation. First authorization for insect as food given in 2021.
General Finding		Consumers unfamiliar with entomophagy evaluate insects based on visual features, while those familiar with it base their judgments on sensory memories.	Weaker disgust is linked to higher purchase intentions for insect-based products.	Neophobia varies across countries and is shaped by cultural, social, and environmental factors		

CHAPTER 3: RESEARCH METHODOLOGY

This chapter describes the methodology applied to test the research hypotheses. It outlines the research approach, the data collection methods, the variables analysed, and the data analysis techniques used.

3.1 Research Approach and Method

There are three broad types of research approach: exploratory, descriptive and explanatory (Sanders et al., 1996). Exploratory research, often associated with qualitative data collection, provides an opportunity for researchers to uncover new insights and identify novel, interesting findings (Elman et al., 2020). Descriptive research seeks to provide a comprehensive overview of a particular situation at a given time (Sanders et al., 1996). Explanatory research seeks to respond to the *Why?* question. It relies on hypothesis testing, deepens the knowledge about a theory and establishes connections between variables being studied (Saunders et al., 2019).

This dissertation undertook a descriptive approach as it sought to analyse consumer attitudes and levels of familiarity with entomophagy across two different cultural settings, based on the collection of quantitative data. This informs about the current state of consumer perceptions, important demographic trends, willingness of accept and a global understanding of the situation regarding the adoption of entomophagy. A deductive paradigm was employed and research hypotheses about associations between variables were tested based on quantitative data collection. However, this research intended to be a snapshot of the current condition, rather than explain casualties or generate theories like explanatory research. It also did not explore deeply subjective perspectives like exploratory research does.

Finally, this dissertation applied a mono-method quantitative approach to collect primary data, namely through the distribution of self-administered online surveys to members of the studied population.

3.2 Population and Sampling

Adult Mexican and Portuguese nationals with internet access composed the two study populations, respectively. Potential participants were recruited through non-probabilistic convenience sampling among the contacts of the author, namely by distributing links to surveys using Facebook and WhatsApp groups. A QR code with the Qualtrics link of the Portuguese version was also shared at CATÓLICA-LISBON for students to submit a response for the survey. Potential participants were informed about the purpose of the study as well as having

their anonymity assured prior to the start of the survey and could withdraw their participation at any time.

Screening questions were included at the start of the surveys to check compliance with population requirements. Those respondents who did not meet the criteria, had their response closed and were re-directed to the end of the survey where they were thanked for their time. However, it is important to mention that since the survey was electronically distributed and anonymous, there was no way to prevent excluded participants from retaking the survey.

3.3 Survey Design

The survey was first designed in Spanish and administered to Mexican nationals, and then translated to Portuguese and administered to Portuguese nationals. Both surveys were identical, except for one question regarding the most popular insect species: grasshoppers in Mexico (Lopez, 2020), and house cricket in Portugal (Direção-Geral da Alimentação e Veterinária, as cited in Deia, 2021). The surveys were programmed and distributed using the Qualtrics software, being both pre-tested prior to their administration. An English version of the distributed survey is included in the Appendix (See Appendix A).

3.3.1 Measures of familiarity

Two types of familiarity were measured in this study: familiarity with direct and by stealth entomophagy. Familiarity with direct entomophagy was assessed through the question, “*What is your level of familiarity with edible insects?*” Meanwhile, familiarity with by stealth entomophagy was evaluated using the question, “*What is your level of familiarity with foods enriched with edible insect protein? (e.g., protein bars, snacks, chocolate, bread, pasta, sports nutrition, sauces).*” The order in which the familiarity questions were presented was randomized. The scale used to measure familiarity was adopted from Costa et al. (2024), which, in turn, had adopted the scale by Costa et al. (2021). The scale used was already adapted to Portuguese and was translated to Spanish for the Mexican survey. The scale with the degrees of familiarity are presented on Table 2.

3.3.2 Measures of consumer acceptance

Three distinct visual stimuli were presented to respondents to measure their acceptance of entomophagy. The first stimulus, an insect salad, assessed willingness to accept direct entomophagy. The second and third stimuli, a protein shake and a bowl of tortilla chips,

measured willingness to accept by stealth entomophagy. Each stimulus was presented in a separate question and the order of presentation was randomized to minimize bias. The question included a detailed description of the food item. Figure 1 displays the visual images of the three stimuli along with their descriptions in English.

Figure 1. Visual Stimuli with Description



This is a gourmet salad made with edible insects.



This is a smoothie mix enriched with edible insect protein.



These are nachos/tortilla chips made with edible insect flour.

The survey also comprised a generic question measuring the acceptance of an edible insect species. Species were selected according to their popularity in each country (Grasshopper in Mexico and House Cricket in Portugal). This question served only as a reference to identify species-specific acceptance within each country and was not used as the main dependent variable since answers were not comparable between country samples.

The scale used to measure stimuli acceptance was the 11-point Juster probability scale (1966), which combines verbal descriptions with numerical probabilities in order to understand

consumers' intentions. The work of Costa et al., (2024) had already adapted the scale to Portuguese and that work was used for the Portuguese survey. For the Mexican survey, it was translated to Spanish by the author of this thesis.

3.3.3 Measures of psychographics

The two primary psychographics of interest in this study were food neophobia and disgust toward insects which were measured with the psychometric tools. To measure the respondents' level of food neophobia, the study used the Food Neophobia scale developed by Pliner and Hobden (1992). This scale includes 10 items. For the Portuguese survey, the Food Neophobia Scale was derived from the work of Costa et al. (2024), which in turn used the Pliner and Hobden (1992) scale that had been validated for Portuguese speakers in earlier studies by Costa and Simão (2018) and Paupérieur et al. (2014). For the Mexican survey, the items were translated into Spanish. The response format was a 7-point Likert-type response scale, where participants rated their agreement with statements. To evaluate participants' disgust towards insects, the survey used an adapted version of a scale developed by Ribeiro et al. (2022), which was based on Rozin's (2014) work. This scale includes five items: "The thought of insects makes me nauseous" "Eating insects is repulsive" "The thought of insects makes me feel unwell" "The idea of consuming insects offends me" and "If an insect crawls onto my favorite food, I won't eat it". The items of the scale were translated to Portuguese and Spanish. The response format was a 7-point Likert-type response scale, where participants rated their agreement with statements. The presentation of the items composing the evaluation of both food neophobia and insect disgust and were randomized.

3.3.4 Sociodemographics and dietary pattern

Participants were asked about sociodemographic factors identified in the literature as influencing the acceptance or rejection of entomophagy: age, gender, region of origin, and highest level of education. To ensure valid responses, participants needed to be adults, with the age range accepted up to 85 years. Gender was provided as three options: male, female, and prefer not to say. Four participants chose not to share their gender and were treated as missing data for gender analysis. The region of origin question varied by country. The Portuguese survey offered six regions: Norte, Centro, Lisboa, Alentejo, Algarve, and Madeira/Açores. The Mexican survey provided five regions: Norte, Bajío, Centro, Sur, and Sureste. Education levels ranged from no formal education to a PhD.

Additionally, participants were asked about their dietary patterns. For the dietary pattern, participants could choose from omnivorous, flexitarian, vegetarian, vegan, or "other" with a written response option. For the purposes of this study, the dietary variable was recoded into two categories: omnivorous and non-omnivorous (encompassing all other responses).

3.4 Variable Categorization

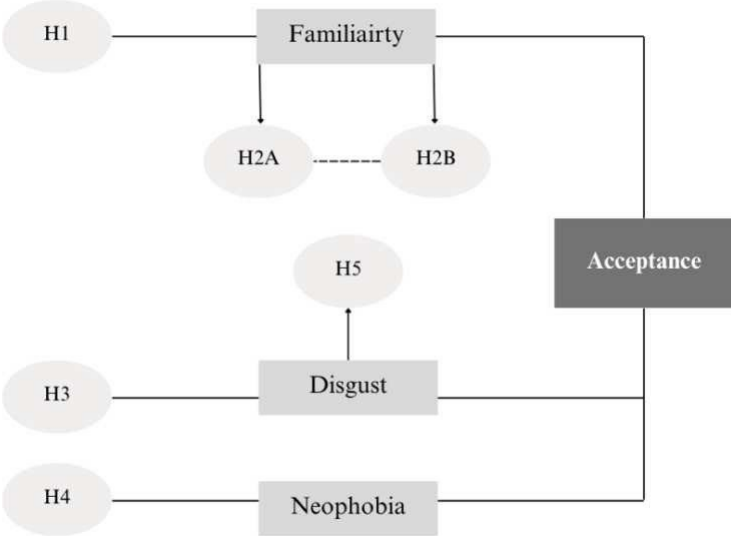
The key dependent variable for the study was acceptance and the rest of the variables were independent. Table 2 provides an overview of the dependent and independent variables used in the study. Figure 2 displays how each of the variables is associated with the research hypotheses.

Table 2. Summary of Dependent and Independent Variables

Dependent Variable			
Variable	Subcategories	Measurement Type	Scale/Details
Acceptance	Insect Salad Protein Shake Tortilla Chips	Metric	<i>1-11 Scale (2= it is certain or almost certain that I would not consumer, 11= it is certain or almost certain that I would consume)</i>
Independent Variables			
Variable	Subcategories	Measurement Type	Scale/Details
Familiarity	Direct Entomophagy By stealth entomophagy	Ordinal	<i>I have never heard of them (1), I have heard of them but never tried (2), I have tried them once (3), I have tried them on several occasions (4), I consume them somewhat frequently (5), I consume them regularly (6)</i>
Disgust		Metric	<i>1-7 Scale (1=Strongly disagree; 4=Neither agree nor disagree; 7=Strongly agree)</i>
Food Neophobia		Metric	<i>1-7 Scale (1=Strongly disagree; 4=Neither agree nor disagree; 7=Strongly agree)</i>
Nationality		Nominal	<i>Portuguese (0), Mexican (1)</i>
Demographics	Age Gender Macro-region Education Diet	Metric Nominal Nominal Ordinal Nominal	<i>18-85 (0) Male, (1) Female, (2) Prefer not to say Tailored to sample No education (0), Primary education (1), Secondary education (2), High school (3), Bachelor (4), Master's (5), Phd (6) Omnivorous (0), Not omnivorous (1)</i>
Insect Species Acceptance*	Direct Entomophagy By stealth entomophagy	Metric	<i>1-11 Scale (2= it is certain or almost certain that I would not consumer, 11= it is certain or almost certain that I would consume)</i>

**Insect Species Acceptance was tailored to the sample, with House Crickets being presented to the Portuguese sample and Grasshoppers to the Mexican sample. Results of this variable were not compared across samples.*

Figure 2. Association Between Variables and Research Hypotheses



3.5 Data Analysis

To analyse the data, a variety of statistical methods and tests were employed to address the study's objectives. Descriptive statistics were utilized to summarize findings related to socio-demographic and dietary characteristics. For metric variables, means and standard deviations were calculated, while medians and interquartile ranges were reported for non-metric variables. Frequency distributions summarized categorical data. The same descriptive statistics (means and standard deviations) were applied to summarize findings of acceptance, food neophobia, and insect disgust.

Data comparisons were conducted between samples to identify and interpret differences. To compare samples means, independent-sample t-tests were used to compare continuous variables (acceptance, age, disgust, food neophobia) between the two samples. This method was chosen to assess if there were significant differences in these variables between the two groups. For categorical variables (gender, education, diet and familiarity) Chi-square tests were performed to evaluate if there were differences in distribution across samples. Given the categorical nature of some variables, non-parametric tests such as Friedman's two-way analysis of variance by ranks were used to compare differences in familiarity levels within the same sample (comparing direct and stealth entomophagy within the Portuguese and Mexican samples).

Pearson correlation analysis was used to examine the relationship between familiarity with entomophagy and willingness to accept it. This method was appropriate to assess the strength and direction of the linear relationship between these variables across the whole sample

(Portugal and Mexico together). Pearson's correlations were also used to evaluate the relationship between insect disgust and food neophobia with familiarity and acceptance, as well as disgust and gender.

Multiple linear regression models were used to identify predictors of acceptance of insect-based foods. This method allowed for the examination of the impact of multiple factors (insect disgust, food neophobia, nationality, and others) on the acceptance of different food stimuli. Three different linear regression models were used, one for each of the three stimuli measuring acceptance. To avoid issues with multicollinearity in the regression models, gender was excluded as a predictor, as it was correlated to insect disgust and food neophobia. To further examine gender (as it was excluded from the linear regression models), independent samples t-tests were conducted separately to compare the levels of insect disgust and food neophobia between males and females. Similarly, familiarity was excluded from the linear regression because it was closely linked to nationality, with one national sample demonstrating significantly higher familiarity than the other. Furthermore, familiarity appeared to lower disgust, making its inclusion potentially redundant when both disgust and nationality were already accounted for. These two variables (gender and familiarity) were excluded to minimize multicollinearity and redundancy in the model.

Finally, the items from the Food Neophobia and Insect Disgust scales were combined into single composite variables by calculating the mean of all item scores for each scale. For the Food Neophobia Scale, half of the items were reverse-coded to ensure that higher scores indicated greater neophobia. A reliability analysis had a Cronbach's Alpha value of .813, confirming the 10 items could be recorded into a single mean for the scale. Similarly, a reliability analysis for the Insect Disgust Scale, had a Cronbach's Alpha value of .847, supporting the calculation of a single mean for all items on the scale. Both scales exhibited satisfactory internal consistency, with Cronbach's Alpha values exceeding the commonly accepted threshold of .70. The reliability analysis was conducted to ensure all items were perceived in the same way, which they were. Only the means of each of the scales were used for analysis and means of single items were not considered for results.

CHAPTER 4: RESULTS AND DISCUSSION

This chapter presents the results of the online survey and evaluates them in relation to the research hypotheses. Additionally, it examines whether the findings align with those discussed in the Literature Review.

4.1 Responses

Table 3 presents the sample size for a study based on exclusion criteria. It compares the responses from participants in Portugal and Mexico, detailing the total responses collected and the reasons for excluding certain responses.

Table 3. Sample Size based on Exclusion Criteria

	Portugal n (%)	Mexico n (%)
Total responses	172 (100%)	194 (100%)
Excluded due to lack of response initiation	12 (6.97%)	-
Excluded based on nationality	15 (8.72%)	12 (6.18%)
Excluded based on age	-	7 (3.60%)
Excluded for non-completion	24 (13.95%)	17 (8.76%)
Total valid responses	121 (70.34%)	158 (81.44%)

4.2 Profile of participant samples

Table 4 presents the summary statistics for the socio-demographic and dietary characteristics measured in the Portuguese and Mexican consumer samples.

Table 4. Similarities and Differences Socio-Demographic and Dietary Characteristics of Samples

	Portugal n=121	Mexico n=158	Test Statistics
	Mean (st.dev)	Mean (st.dev)	t- test (p-value)
Age	28.04 (10.52)	37.86 (16.14)	-5.810 (<.001)
Education*	5.21 (.90)	5.15 (.65)	-.588 (.557)
	% (n)	% (n)	Chi Square (p-value)
Female**	56.1 (68)	69.6 (110)	6.205 (.045)
Omnivorous	90.9 (110)	87.9 (139)	.615 (.433)

* Also measured tested with non-parametric tests, which proved not significant (Independent-Sample Median Test summary Chi-square: 1.647, p-value: .199, Median: 5 for both samples)

**There were 3 missing values for gender in Portugal and 1 in Mexico of participants who chose not to share their gender

In terms of region of origin, samples cannot be compared as natural regions differ. Nevertheless, participants' region was highly concentrated in the *Lisboa* region for Portugal (66.1%) and in the *Centro* region for Mexico (82.3%). As such, it was not possible to test whether region was associated with acceptance of entomophagy within each country, as originally intended (See Appendix B).

4.3 Evaluating Familiarity

4.3.1 The impact of Familiarity on Acceptance

Results of a correlation analysis between familiarity and acceptance are depicted in Table 5. They show that familiarity with entomophagy is significantly positively correlated with a general willingness to accept this practice, as proposed in *H1*. In particular, familiarity with direct entomophagy showed a strong relationship with willingness to accept, while familiarity with entomophagy by stealth had a moderate relationship.

Table 5. Correlation Matrix of Familiarity and Acceptance

(Pearson Correlation n=279)			
	Insect Salad	Protein Shake	Tortilla Chips
Familiarity direct entomophagy	.565**	.465**	.504**
Familiarity by stealth entomophagy	.228**	.256**	.175**

*Correlation is significant at the .05 level

**Correlation is significant at the .01 level

4.3.2 Differences on Familiarity

Table 6 presents the results for differences in familiarity across samples, distinguishing between direct familiarity and familiarity by stealth. The difference was significant for direct entomophagy, with the Mexican sample being more familiar with this practice than the Portuguese sample. The difference was also significant for entomophagy by stealth, with the Latin American sample being again more familiar. This confirms *H2A* that stated that consumers in Mexico have a higher familiarity with direct and by stealth entomophagy than those in Portugal.

Table 6. Frequency Distributions of Familiarity by Sample

		Portugal n=121	Mexico n=158	Test Statistics
Variable	Scale	% (n)	% (n)	Chi-Square (p-value)
Familiarity direct entomophagy	I have never heard of them (1)	14.9 (18)	5.1 (8)	90.087 (<.001)
	I have heard of them but never tried (2)	67.8 (82)	22.2 (35)	
	I have tried them once (3)	13.2 (16)	27.8 (44)	
	I have tried them on several occasions (4)	2.5 (3)	36.1 (57)	
	I consume them somewhat frequently (5)	.8 (1)	5.1 (8)	
	I consume them regularly (6)	.8 (1)	3.8 (6)	
Familiarity by stealth entomophagy	I have never heard of them (1)	27.3 (33)	20.9 (33)	15.826 (.007)
	I have heard of them but never tried (2)	51.2 (62)	40.5 (64)	
	I have tried them once (3)	6.6 (8)	13.3 (21)	
	I have tried them on several occasions (4)	3.3 (4)	13.9 (22)	
	I consume them somewhat frequently (5)	5.8 (7)	3.2 (5)	
	I consume them regularly (6)	5.8 (7)	8.2 (13)	

Furthermore, non-parametric tests were performed to evaluate if the direct and by stealth familiarity differed within the same sample. Table 7 presents the results for both the Portuguese and Mexican samples. Results showed that Portuguese have a similar level of familiarity with both types of entomophagy, while Mexicans are more familiar with direct entomophagy than by stealth, since the difference was significant.

Table 7. Friedman’s Two-Way Analysis of Variance by Ranks Summary to evaluate Levels of Familiarity

	Direct Familiarity	By Stealth Familiarity	Test Statistic
Sample	Mean (interquartile range)	Mean (interquartile range)	Chi Square Value (<i>p</i> -value)
Portuguese Sample (n=121)	2 (0)	2 (1)	1.588 (.208)
Mexican Sample (n=158)	3 (2)	2 (2)	31.360 (<.001)

Regarding willingness to accept, Table 8 presents how likely each sample is willing to accept each of the three presented visual stimuli. Willingness to accept was higher for all 3 stimuli in the Mexican sample than in the Portuguese one, as stated in *H2B*. The two samples aligned in their preference order for the three stimuli, favouring tortilla chips first, followed by the protein shake, and finally the insect salad.

Table 8. Willingness to Accept Entomophagy based on Visual Stimuli

	Portugal n=121	Mexico n=158	Test Statistics
Stimuli	Mean (st. dev)	Mean (st. dev)	t-test (<i>p</i> -value)
Insect Salad	2.51 (2.45)	4.73 (3.49)	-5.961 (<.001)
Protein Shake	3.67 (2.73)	5.89 (3.33)	-5.936 (<.001)
Tortilla Chips	4.70 (3.07)	6.94 (3.46)	-5.602 (<.001)

Responses provided on an 11-point Likert-type scale (1=It is certain or almost certain that I would not consume; 11=It is certain or almost certain that I would consume)

4.4. Acceptance Based on the Most Popular National Insect Species

Acceptance of House Cricket as food in Portugal (M = 2.89, SD = 2.45) was lower than the acceptance of food made from House Crickets (M = 3.63, SD = 2.70). In contrast, acceptance of grasshoppers as food in Mexico (M = 6.15, SD = 3.52) was similar to the acceptance of food made from grasshoppers (M = 6.08, SD = 3.29). Overall, acceptance was considerably higher in Mexico, even when accounting for the different insect species.

4.5 Evaluating Predictors of Acceptance

4.5.1 Correlation Analysis

The results of a Pearson correlational analysis between the acceptance of insect-based stimuli, insect disgust and food neophobia for the pooled sample data (n=279) can be seen in Table 9. Results show insect disgust significantly impacts acceptance across all food stimuli. Higher disgust levels led to lower acceptance, results that align with *H3*. Additionally, as familiarity increases, disgust tends to decrease. Food neophobia significantly influences the acceptance of all three food stimuli, with higher levels of food neophobia associated with lower acceptance. These findings are consistent with *H4*. Both food neophobia and disgust are negatively correlated with food acceptance, but disgust has stronger associations across all variables. This suggests disgust is a more dominant factor in shaping willingness to accept entomophagy.

Table 9. Correlation Matrix for Acceptance and Familiarity based on Insect Disgust and Food Neophobia

Pearson Correlation (n=279)		
	Insect Disgust	Food Neophobia
Familiarity direct entomophagy	-.477**	-.268**
Familiarity by stealth entomophagy	-.077**	-.093
Insect Salad	-.568**	-.288**
Protein Shake	-.528**	-.319**
Tortilla Chips	-.583**	-.332**

*Correlation is significant at the .05 level

**Correlation is significant at the .01 level

4.5.2 Linear Regression Models

Table 10 displays which psychographic and demographic variables are predictors of entomophagy. Three linear regression models are presented in Table 10, each model for one of the three visual stimuli. Findings in the three linear regression models are all consistent with *H3* and *H4*, both insect disgust and food neophobia are predictors of entomophagy acceptance. Individuals who experience higher levels of insect disgust and food neophobia are less likely to accept any of the three presented stimuli. Insect disgust had a stronger negative effect over acceptance than food neophobia.

Furthermore, the linear regression models indicated that nationality is a significant factor in predicting acceptance, with Mexican nationals being more inclined to accept all three stimuli compared to Portuguese nationals.

Table 10. Results of Simple Linear Regression Model

(n=279)	standardized β	t-test	p-value
Regressor: Insect Salad (Adjusted R²= .356)			
Predictor: Insect Disgust	-.441	-7.704	<.001
Predictor: Food Neophobia	-.139	-2.566	.011
Predictor: Nationality	.191	3.438	<.001
Predictor: Age	.016	.305	.761
Predictor: Education	-.086	-1.717	.087
Regressor: Protein Shake (Adjusted R²= .331)			
Predictor: Insect Disgust	-.368	-6.310	<.001
Predictor: Food Neophobia	-.197	-3.585	<.001
Predictor: Nationality	.226	3.997	<.001
Predictor: Age	-.004	-.083	.934
Predictor: Education	-.080	-1.584	.114
Regressor: Tortilla Chips (Adjusted R²= .377)			
Predictor: Insect Disgust	-.447	-7.945	<.001
Predictor: Food Neophobia	-.170	-3.209	.001
Predictor: Nationality	.199	3.657	<.001
Predictor: Age	-.061	-1.176	.241
Predictor: Education	-.056	-1.137	.256

ANOVA tables for each regression analysis are presented in Appendix C.

Diet was excluded from the regression because the sample was unbalanced with most participants being omnivorous. Familiarity was excluded since results showed it was significantly associated with nationality. Nationality was correlated with direct familiarity (Pearson Correlation: .505; p -value: $<$.001) and with stealth familiarity (Pearson Correlation: .126; p -value: .035). Gender was not included in any of the linear regression models to avoid multicollinearity. Gender was correlated with Insect Disgust (Pearson Correlation .251; p -value: $<$.001) and with Food Neophobia (Pearson Correlation .218; p -value: $<$.001). Since gender was excluded from the linear regression model to prevent multicollinearity, independent samples t-tests were conducted to examine whether insect disgust and food neophobia levels differ significantly between males and females. Results are presented in Table 11.

Table 11. Means of Insect Disgust and Food Neophobia per Gender

(n=275)*			
	Female (n=178)	Male (n=97)	Test Statistics
	Mean (St.dev)	Mean (St.dev)	t-test (p-value)
Insect Disgust	4.19 (1.48)	3.44 (1.20)	-4.293 (<.001)
Food Neophobia	3.57 (.91)	3.15 (.84)	-3.683 (<.001)

Responses provided on a labelled 7-point Likert-type scale (1=Strongly disagree; 4=Neither agree nor disagree; 7=Strongly agree)

**There were 4 missing values for gender of respondents who chose not to share their gender*

4.6 Psychographic Measures

Table 12 shows how samples differed or aligned in their levels of insect disgust and food neophobia. Results show that the Portuguese sample experiences higher levels of insect disgust than the Mexican sample at a significant level. This finding is consistent with $H5$. Contrary to insect disgust, levels of food neophobia were not different across samples.

Table 12. Comparison of Insect Disgust and Food Neophobia Across Samples

	Portugal (n=121)	Mexico (n=158)	Test Statistics
Variable	Mean (st.dev)	Mean (st.dev)	t-test (p-value)
Insect Disgust	4.47 (1.40)	3.49 (1.31)	6.003 (<.001)
Food Neophobia	3.33 (.92)	3.48 (.90)	-1.362 (.174)

Responses provided on a labelled 7-point Likert-type scale (1=Strongly disagree; 4=Neither agree nor disagree; 7=Strongly agree)

Table 13 highlights how insect disgust differs between Portuguese and Mexican participants, considering gender differences. Portuguese females reported higher levels of disgust compared to Mexican females, and Portuguese males also showed greater disgust than Mexican males.

Table 13. Comparison of Insect Disgust Levels Between Portuguese and Mexican Participants by Gender

	Portuguese females (n=68)	Mexican females (n=110)	Test Statistics
Variable	Mean (st.dev)	Mean (st.dev)	t-test (p-value)
Insect Disgust	5.04 (1.23)	3.68 (1.39)	6.642 (<.001)
	Portuguese males (n=50)	Mexican males (n=47)	Test Statistics
Variable	Mean (st.dev)	Mean (st.dev)	t-test (p-value)
Insect Disgust	3.79 (1.26)	3.07 (1.02)	3.071 (.001)

Responses provided on a labelled 7-point Likert-type scale (1=Strongly disagree; 4=Neither agree nor disagree; 7=Strongly agree)

4.7 Discussion

Overall results were consistent with the research hypotheses presented in Chapter 2, and with previous literature.

H1: Familiarity with entomophagy is positively associated with acceptance of insect-based foods

Results of statistical analysis showed that there was a significant correlation between an individual's level of familiarity with entomophagy and their willingness to accept it. This correlation was positive for both types of entomophagy (direct and by stealth). The correlation was also positive for all three of the visual stimuli presented to the respondents. In particular, the correlation with direct entomophagy was stronger than with stealth entomophagy. Indeed, correlations with stealth entomophagy were moderate. These findings align with previous research suggesting that familiarity is not only a key variable for entomophagy's acceptance, but also that it will increase consumers' willingness to accept insect-based foods (Kröger et al, 2022; Tan et al, 2015).

H2A: Consumers in Mexico are more familiar with entomophagy than consumers in Portugal, being also more likely to accept insect-based foods (H2B)

H2A: Results showed that the Mexican sample was more familiar with both types of entomophagy than the Portuguese sample. This difference was significant for both types of entomophagy. When it comes to direct entomophagy, most of the Portuguese participants more than half of them were aware of edible insects, whereas more than one third of the Mexican participants had consumed them on multiple occasions. Regarding stealth entomophagy, both samples had most of the participants that were aware of it but have never tried it. The difference was more significant for the familiarity with edible insects than for the familiarity with insect-based products. This suggests the gap of familiarity between countries is bigger in the case of edible insects. Furthermore, the Portuguese sample had a similar level of familiarity with both types of entomophagy, but the Mexican sample was more familiar with edible insects than with insect-based food. The high level of familiarity with edible insects observed in the Mexican sample aligns with research highlighting entomophagy as a long-standing practice in Mexico (Castro & Chambers, 2018).

H2B: Acceptance for the three visual stimuli was higher in the Mexican sample than in the Portuguese. This difference was significant with all three of the presented stimuli. Research by Ribeiro et al. (2022) for Portugal and Tzompa-Sosa et al., (2023) for Mexico suggested that both countries are more likely to accept entomophagy when insects are incorporated into food in a disguised manner. The findings of this study align with this, as both samples demonstrated a greater willingness to accept insect-based foods compared to whole edible insects.

The three linear regression models indicated that nationality was a significant predictor of acceptance for all stimuli. Nationality had a greater influence than food neophobia on acceptance but lower when compared to insect disgust. Specifically, being Mexican was associated with a higher positive effect on acceptance, while being Portuguese was linked to a more negative effect.

H3: Insect disgust is negatively associated with willingness to accept insect-based foods

The three multiple regression analyses on predictors of insect-based food acceptance showed that insect disgust negatively predicts acceptance, consistent with the literature, which identified disgust as a key negative predictor of entomophagy's acceptance (Kröger et al, 2022; Ribeiro et al., 2022). The impact of insect disgust was greater than the impact of food neophobia in all three models.

Additionally, insect disgust varied with gender, with females showing higher levels of disgust than males, and this difference was statistically significant. This finding aligns with previous

literature that found women are less likely to accept entomophagy due to experiencing higher levels of insect disgust (Kröger et al., 2022; Ribeiro et al., 2022; Castro & Chambers, 2018). Previous literature suggests that age is a predictor of acceptance, with younger generations being more open to entomophagy (Tzompa-Sosa et al., 2023). However, the findings of this research did not support this claim, as age was not identified as a predictor.

Furthermore, a correlation analysis showed that insect disgust had a strong negative relationship with all three stimuli. As insect disgust increases, the acceptance of insect-based foods tends to decrease.

H4: Food neophobia is negatively associated with willingness to accept insect-based foods

The three multiple regression analyses conducted to identify predictors of stimulus acceptance revealed that food neophobia negatively predicts acceptance. This finding aligns with those of Kröger et al. (2022), which state that food neophobia significantly reduces acceptance. However, insect disgust had a stronger negative impact on acceptance than food neophobia across all three models. Although the literature suggests that food neophobia varies across countries and demographic groups (Siddiqui et al., 2022), this research found no significant difference in food neophobia between the Mexican and Portuguese samples, thus failing to support this claim. However, the results did show that food neophobia varies by gender, with females exhibiting higher levels of food neophobia than males, and this difference was statistically significant.

Additionally, a correlation analysis showed that food neophobia had a moderate negative relationship with all three stimuli. Individuals with higher levels of food neophobia are less likely to accept insect-based foods.

H5: Consumers in Mexico have lower insect disgust than consumers in Portugal

Findings showed that the Mexican sample experienced lower levels of disgust towards insects than the Portuguese sample. This difference was statistically significant. This may be because, as results show, familiarity decreases disgust. Given that the Mexican sample was more familiar, they also experienced lower levels of disgust. Contrary, the Portuguese sample was less familiar, had higher levels of disgust. In Mexico, where eating insects is more culturally accepted and common, people reported lower levels of disgust. In Portugal, where eating insects is less familiar and not part of the culture, people showed higher levels of disgust. If disgust were a phobia, it would likely be a universal reaction that doesn't change based on nationality.

However, the fact that it varies between nationalities shows that disgust is influenced by cultural experiences and norms, not just an innate fear. These findings are consistent with the literature; disgust towards insects is not a phobia, but rather a socio-cultural negative emotion (Ribeiro et al., 2022). These findings align with literature suggesting that disgust levels are higher in countries with Western values (Castro & Chambers, 2018), such as Portugal, which shows higher levels of disgust than Mexico. While both countries are in the Western Hemisphere, Mexico is a blend of Western and indigenous influences, whereas Portugal is more closely aligned with Western cultural norms.

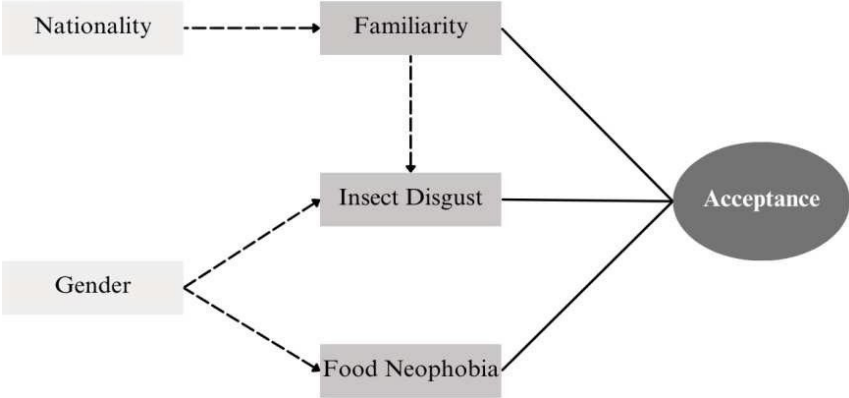
Table 14 shows a summary of the findings and Figure 3 displays a diagram with the pathways influencing acceptance.

Table 14. Overview of Key Findings

	Acceptance	Familiarity	Insect Disgust	Food Neophobia	Drivers of Acceptance	Species
Mexico		There is a higher degree of familiarity for direct entomophagy than entomophagy by stealth				34.2% would accept whole grasshoppers with a likelihood rated as fairly likely or higher
Portugal		Levels of familiarity between direct and by stealth entomophagy are similar	Higher levels of insect disgust than in Mexico	Similar levels of food neophobia to Mexico		8.3% would accept whole house crickets with a likelihood rated as fairly likely or higher
General Finding	Stimuli with non visible (disguised) insects are preferred over whole insect stimuli	Familiarity with both types of entomophagy were higher in Mexico than in Portugal	Influenced by gender, females experience higher levels of insect disgust	Influenced by gender, females more food neophobic	Familiarity, Disgust and Food Neophobia	

Appendix D presents frequency tables for the acceptance of the most popular insect species by sample.

Figure 3. Pathways Influencing Acceptance



CHAPTER 5: CONCLUSION

This chapter summarizes the main findings of the study and discusses their practical and theoretical implications. Furthermore, it highlights the limitations of the research and proposes directions for future studies.

5.1 Main Findings and Implications

Environmental pressures have led industries to investigate sustainable sources, such as the food industry which has had to innovate with meat substitutes (Siddiqui et al., 2022). One of these highly innovative food sources in European countries, insects as food, is not so innovative in other regions of the world. One of these regions being Mexico, where indigenous traditions of entomophagy persist today and are viewed as a cultural heritage and an identity symbol (Hurd et al., 2019). Insects have been studied to be nutritious, based on protein content and amino acids, and sustainable as they require less water and have less emissions than traditionally meat sources of protein (Tang et al., 2019). Considering this, Start-Ups in the Western world have begun to incorporate insects as a source of sustainable protein in innovative products (Shenoy, 2024). However, despite nutritional and sustainable claims, entomophagy still faces major barriers for its acceptance, such as insect disgust and food neophobia (Kröger et al., 2022). This dissertation compared acceptance of entomophagy between two very different cultural contexts, Portugal and Mexico. The aim of the dissertation was to evaluate the impact of familiarity on acceptance of entomophagy and to identify other factors that could predict acceptance by answering the research questions:

RQ1: Do consumers differ in their acceptance of entomophagy based on different levels of familiarity?

Consumers' acceptance of entomophagy was influenced by familiarity, with greater familiarity significantly increasing willingness to accept edible insects and insect-based foods. This effect was stronger for direct entomophagy than for stealth forms. Familiarity was affected by nationality.

RQ2: What are the key cultural and psychographic factors that impact the acceptance of entomophagy in Mexico and Portugal, and how do these factors compare cross-culturally?

Demographic and psychographic factors, such as nationality, gender, insect disgust, and food neophobia, played key roles in entomophagy acceptance, with notable differences between Mexico and Portugal. Mexicans exhibited greater familiarity and lower disgust, reflecting their cultural tradition, while Portuguese participants had higher disgust and lower familiarity, consistent with Western norms. Insect disgust was a stronger barrier than food neophobia. Females showed higher levels of insect disgust and food neophobia than males.

The dissertation offers valuable insights for businesses and policymakers promoting insect-based foods. Since familiarity and disgust related to entomophagy appear to vary greatly by country, applying the same standardized strategy to enter foreign markets is likely ineffective, demanding the development of localized marketing strategies and promotional campaigns for each market. In Portugal, where familiarity with entomophagy is low, companies should prioritize educational campaigns and create opportunities for consumers to be exposed to insect-based foods. Likewise, technical development should ensure that edible insect ingredients are inconspicuous in end products, as this greatly increases their chances of acceptance. Additionally, gender-based differences suggest that targeted gender marketing strategies could further enhance effectiveness. By highlighting the intersection of cultural and psychological factors, the thesis provides a practical framework for driving consumer acceptance and advancing sustainable food solutions globally.

The dissertation also added to the growing body of literature on entomophagy by providing cross-cultural insights into how familiarity, disgust, and food neophobia affect consumer acceptance in two distinct cultural contexts, Mexico and Portugal. It further built on findings stating that familiarity is a key driver of acceptance, while emphasizing that its impact is stronger for direct entomophagy. Furthermore, the study enriched cultural perspectives on disgust by demonstrating that it is not an innate or universal response but rather shaped by socio-cultural norms. Additionally, the research identified nationality as an influential factor, adding to the discussion of cross-cultural acceptance of entomophagy. Finally, the findings on gender differences contribute to psychographic segmentation literature.

5.2 Limitations and Future Research

This research examined the various factors influencing the acceptance of entomophagy in two distinct groups, differentiated by nationality. The study built on the literature, which identified disgust and neophobia as two key factors influencing acceptance. Consequently, the data

collection primarily focused on these two variables. However, the study had limitations, as the acceptance of entomophagy can be influenced by a wide range of factors beyond those explored here. As mentioned in the Literature Review, other factors that may influence the acceptance of entomophagy include travel habits, previous consumption and consumers with adventurous spirits. Future research could explore these factors further, examining how this interacts with insect disgust and food neophobia.

Furthermore, many insights into the acceptance of entomophagy require qualitative data collection methods to be fully understood, such as the finding from Hurd et al., (2019), which revealed that entomophagy can be an integral part of the regional identity. Also, as stated in the research from Tan et al., (2015), sometimes the rejection or the embracing of insects as food depends on individual sensorial previous experience with the food. This dissertation, based on its quantitative nature, did not ask participants with previous experience about the like or dislike of sensory properties of the insects, which could be studied by future research. Additionally, the sample was highly concentrated in the central region of both countries, which did not allow to make conclusions based on the impact of a macro-region in acceptance. The Literature Review shows as stated in Hurd et al., (2019), the importance of region in acceptance, especially in Mexico, with the south having a rich culture of entomophagy.

The samples were not gender-balanced, with the Mexican group having more females than males, which could have biased the disgust and food neophobia responses. Research shows that females generally report stronger insect disgust and food neophobia reactions than males, which might have influenced the results. Future studies should ensure equal gender representation to avoid such biases and improve generalizability. Regarding the sample, the non-probability convenience sampling may have generated selection bias, self-selection bias and an under-representation of some groups. In addition, the self-administered nature of the survey limited the ability to control for respondent behaviour, which may have led to inaccurate responses or misinterpretation of the questions. Thus, future research should apply other sampling methods. Finally, willingness to accept was measured after a stimulus was presented to the respondent. While these findings provide valuable insights into acceptance, they cannot be generalized, as a different stimulus, such as another insect species, could have elicited a different response from the participant. Thus, future research could investigate acceptance of other insect species, products derived from insects or, also important and not studied in this dissertation, willingness to accept indirect entomophagy.

REFERENCES

- Aldridge, V., Dovey, T. M., & Halford, J. C. (2008). The role of familiarity in dietary development. *Developmental Review*, 29(1), 32–44.
<https://doi.org/10.1016/j.dr.2008.11.001>
- Beaton, K. (2024, April 19). *On-the-Go Gourmet: Rapid pace of life fuels demand for convenient foods* - The Food Institute. The Food Institute.
<https://foodinstitute.com/focus/rapid-pace-of-life-drives-convenient-snacks/>
- Carazan, V. (2023, October 11). The Power of Familiarity in Branding: A Guide to building Trust and recognition. *Medium*. https://medium.com/@vadimcarazan_11752/the-power-of-familiarity-in-branding-a-guide-to-building-trust-and-recognition-bd024fe57fe4
- Carreño, D. (2020, March 27). *Muy nutritivos, pero los insectos comestibles en México están al margen de la ley*. Goula. <https://goula.lat/muy-nutritivos-pero-los-insectos-comestibles-en-mexico-estan-al-margen-de-la-ley/>
- Castro, M., & Chambers, E. (2018). Willingness to eat an insect based product and impact on brand equity: A global perspective. *Journal of Sensory Studies*, 34(2).
<https://doi.org/10.1111/joss.12486>
- Costa, A.I.A., Monteiro, M.J.P., Maya, C., Rocha, C. Faria, B.F., Lima, R.C., Cunha, L.M., & Roos, N. (2024). Consumer sensory profiling and liking of Bolognese-type sauces: How do insect and plant foods really fare against red meat? *Journal of Insects as Food and Feed*, 1–32. <https://doi.org/10.1163/23524588-00001221>

- Dagevos, H., & Taufik, D. (2023). Eating full circle: Exploring consumers' sympathy for circularity in entomophagy acceptance. *Food Quality and Preference*, *105*, 104760. <https://doi.org/10.1016/j.foodqual.2022.104760>
- Dangelico, R. M., Ceccarelli, G., & Fraccascia, L. (2024). Consumer behavioral intention toward sustainable biscuits: An extension of the theory of planned behavior with product familiarity and perceived value. *Business Strategy and the Environment*. <https://doi.org/10.1002/bse.3774>
- Deia. (2021, August 2). Los insectos, el gran manjar portugués. *Deia*. <https://www.deia.eus/vivir/2021/08/02/insectos-gran-manjar-portugues-1944185.html>
- Delgado, M. C., Chambers, E., Carbonell-Barrachina, A., Artiaga, L. N., Quintanar, R. V., & Hernandez, A. B. (2020). Consumer acceptability in the USA, Mexico, and Spain of chocolate chip cookies made with partial insect powder replacement. *Journal of Food Science*, *85*(6), 1621–1628. <https://doi.org/10.1111/1750-3841.15175>
- Edenbrandt, A. K., Gamborg, C., & Thorsen, B. J. (2020). Observational learning in food choices: The effect of product familiarity and closeness of peers. *Agribusiness*, *36*(3), 482–498. <https://doi.org/10.1002/agr.21638>
- Elman, C., Gerring, J., & Mahoney, J. (2020). *The production of knowledge: Enhancing Progress in Social Science*. Cambridge University Press.
- Fischer, A. R., & Frewer, L. J. (2009). Consumer familiarity with foods and the perception of risks and benefits. *Food Quality and Preference*, *20*(8), 576–585. <https://doi.org/10.1016/j.foodqual.2009.06.008>
- Garrido, D. (2023, June 30). Los insectos comestibles de la gastronomía mexicana. *Architectural Digest*. <https://www.admagazine.com/articulos/los-insectos-comestibles-de-la-gastronomia-mexicana>

Gobierno de México - Secretaría de Agricultura y Desarrollo Rural (2018) *Insectos*

comestibles. gob.mx. [https://www.gob.mx/agricultura/es/articulos/hay-una-mosca-en-mi-sopa-insectos-comestibles-](https://www.gob.mx/agricultura/es/articulos/hay-una-mosca-en-mi-sopa-insectos-comestibles-156649#:~:text=En%20la%20actualidad%2C%20M%C3%A9xico%20cuenta,una%20tercera%20parte%20de%20ellos)

[156649#:~:text=En%20la%20actualidad%2C%20M%C3%A9xico%20cuenta,una%20tercera%20parte%20de%20ellos](https://www.gob.mx/agricultura/es/articulos/hay-una-mosca-en-mi-sopa-insectos-comestibles-156649#:~:text=En%20la%20actualidad%2C%20M%C3%A9xico%20cuenta,una%20tercera%20parte%20de%20ellos).

Hopper, E. (2019, December 13). *What is the mere exposure effect in psychology?* ThoughtCo.

<https://www.thoughtco.com/mere-exposure-effect-4777824>

Hurd, K. J., Shertukde, S., Toia, T., Trujillo, A., Pérez, R. L., Larom, D. L., Love, J. J., & Liu,

C. (2019). The cultural importance of edible insects in Oaxaca, Mexico. *Annals of the Entomological Society of America*, *112*(6), 552–559.

<https://doi.org/10.1093/aesa/saz018>

IPIFF. (2024, October 4). *EU Novel Food legislation and other EU requirements applying to insect food producers – EU Insect Producer Guidelines – IPIFF*. International Platform of Insects for Food and Feed, Brussels. <https://ipiff.org/insects-novel-food-eu-legislation-2/>

Juster, F. T. (1966). Consumer Buying Intentions and Purchase Probability: An Experiment in Survey Design. *Journal of the American Statistical Association*, *61*(315), 658–696.

<https://doi.org/10.1080/01621459.1966.10480897>

Khatsenkova, S. (2023, February 7). Fact check: Is the EU really going to force us to eat insects without our knowledge? *Euronews*.

[https://www.euronews.com/green/2023/02/02/fact-check-is-the-eu-really-going-to-force-us-to-eat-insects-without-our-](https://www.euronews.com/green/2023/02/02/fact-check-is-the-eu-really-going-to-force-us-to-eat-insects-without-our-knowledge#:~:text=According%20to%20a%202020%20report,most%20receptive%20to%20the%20idea)

[knowledge#:~:text=According%20to%20a%202020%20report,most%20receptive%20to%20the%20idea](https://www.euronews.com/green/2023/02/02/fact-check-is-the-eu-really-going-to-force-us-to-eat-insects-without-our-knowledge#:~:text=According%20to%20a%202020%20report,most%20receptive%20to%20the%20idea).

- Kröger, T., Dupont, J., Büsing, L., & Fiebelkorn, F. (2022). Acceptance of Insect-Based Food Products in Western Societies: A Systematic review. *Frontiers in Nutrition*, 8. <https://doi.org/10.3389/fnut.2021.759885>
- Lopez, R. (2020, April 9). Insectos, ingrediente clave de la gastronomía mexicana. *Gaceta UNAM*. <https://www.gaceta.unam.mx/insectos-ingrediente-clave-de-la-gastronomia-mexicana/#:~:text=Hoy%20en%20d%C3%ADa%20se%20han,m%C3%A1s%20%9D%2C%20inform%C3%B3%20Pino%20Moreno.>
- Martin, W., & Vos, R. (2024). The SDGs and Food System Challenges: Global Trends and Scenarios toward 2030. In *INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE* (Discussion Paper 02237). <https://cgspace.cgiar.org/server/api/core/bitstreams/db7284f1-98a8-4168-9617-7879c0aed1ad/content>
- McCarthy, K. (2024, February 15). *What is the Atlantic diet? How a Spanish, Portuguese-inspired diet could reduce metabolic syndrome risk*. ABC News. <https://abcnews.go.com/GMA/Food/atlantic-diet-spanish-portuguese-inspired-what-to-know/story?id=107257704>
- Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, 19(2), 105–120. [https://doi.org/10.1016/0195-6663\(92\)90014-w](https://doi.org/10.1016/0195-6663(92)90014-w)
- Prochazka, P., Soukupova, J., Abrham, J., Mullen, K. J., Tomsik, K., Cechura, L., Cabelkova, I., & Smutka, L. (2024). Protein consumption in Europe: Sustainability, tradition, and policy implications. *Sustainable Development*. <https://doi.org/10.1002/sd.3171>
- Reed, M., Norwood, B. F., Hoback, W. W., & Riggs, A. (2021). A survey of willingness to consume insects and a measure of college student perceptions of insect consumption

- using Q methodology. *Future Foods*, 4, 100046.
<https://doi.org/10.1016/j.fufo.2021.100046>
- Ribeiro, J. C., Gonçalves, A. T. S., Moura, A. P., Varela, P., & Cunha, L. M. (2022). Insects as food and feed in Portugal and Norway – Cross-cultural comparison of determinants of acceptance. *Food Quality and Preference*, 102, 104650.
<https://doi.org/10.1016/j.foodqual.2022.104650>
- Robinson, T. (2021, December 30). *La historia del pollo y la comida mexicana - Backyard Taco*. Taco De Patio. <https://backyardtaco.com/es/blog/pollo-comida-mexicana-historia/>
- Saunders, M., Lewis, P., & Thornhill, A. (2019). Research methods for business students, 8th ed. In *Pearson eBooks*. <http://dspace.uniten.edu.my/handle/123456789/18304>
- Shahbandeh, M. (2024, March 18). *Topic: Edible insects*. Statista. <https://www.statista.com/topics/4806/edible-insects/#topicOverview>
- Shenoy, H. (2024, May 7). *5 Insect-Based Protein Startups leading the industry in 2024*. GreyB. <https://www.greyb.com/blog/insect-based-protein-startups/>
- Siddiqui, S. A., Zannou, O., Karim, I., Kasmiami, N., Awad, N. M. H., Gołaszewski, J., Heinz, V., & Smetana, S. (2022). Avoiding food neophobia and Increasing Consumer Acceptance of New Food Trends—A decade of research. *Sustainability*, 14(16), 10391. <https://doi.org/10.3390/su141610391>
- Tan, H. S. G., & House, J. (2018). Consumer acceptance of insects as food: Integrating psychological and socio-cultural perspectives. In *Springer eBooks* (pp. 375–386). https://doi.org/10.1007/978-3-319-74011-9_23
- Tan, H. S. G., Fischer, A. R., Tinchán, P., Stieger, M., Steenbekkers, L., & Van Trijp, H. C. (2015). Insects as food: Exploring cultural exposure and individual experience as

- determinants of acceptance. *Food Quality and Preference*, 42, 78–89.
<https://doi.org/10.1016/j.foodqual.2015.01.013>
- Tang, C., Yang, D., Liao, H., Sun, H., Liu, C., Wei, L., & Li, F. (2019). Edible insects as a food source: a review. *Food Production Processing and Nutrition*, 1(1).
<https://doi.org/10.1186/s43014-019-0008-1>
- Tzompa-Sosa, D. A., Moruzzo, R., Mancini, S., Schouteten, J. J., Liu, A., Li, J., & Sogari, G. (2023). Consumers' acceptance toward whole and processed mealworms: A cross-country study in Belgium, China, Italy, Mexico, and the US. *PLoS ONE*, 18(1), e0279530. <https://doi.org/10.1371/journal.pone.0279530>
- Van Huis, A. (2014, November 24). *Entomophagy | Definition, Benefits, Sustainable, Nutritious Insect-Based Diet, & Facts*. Encyclopedia Britannica.
<https://www.britannica.com/topic/entomophagy>
- Van Huis, A. (2017). Edible insects: marketing the impossible? *Journal of Insects as Food and Feed*, 3(2), 67–68. <https://doi.org/10.3920/jiff2017.x003>
- Verneau, F., La Barbera, F., Kolle, S., Amato, M., Del Giudice, T., & Grunert, K. (2016). The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy. *Appetite*, 106, 30–36.
<https://doi.org/10.1016/j.appet.2016.02.006>
- Voss, J. L., & Paller, K. A. (2008). Brain substrates of implicit and explicit memory: The importance of concurrently acquired neural signals of both memory types. *Neuropsychologia*, 46(13), 3021–3029.
<https://doi.org/10.1016/j.neuropsychologia.2008.07.010>

APPENDIX

Appendix A. Online Survey

Start of Block: Ethics concerns

Q0 Hello, my name is Ana, and I am a Master's student in Business Management at CATÓLICA-LISBON. I am currently working on my thesis and researching a topic that I am passionate about: innovative foods and food preferences across different cultures. This survey aims to compare the acceptance of a type of innovative food between my country, Mexico, and Portugal. All responses are anonymous, and the data collected will be used exclusively for my research. The average time to complete the survey is 5 minutes. Thank you for your valuable contribution!

▼ Click to write Choice 1 (1) ... Click to write Choice 70 (70)

End of Block: Ethics concerns

Start of Block: Screening

Q17 What is your age?

▼ Under 18 (1) ... 86 or older (70)

Skip To: Q1 If What is your age? = Under 18

Q1 Are you a Portuguese National? (Different for Mexico)

Yes (1)

No (2)

Skip To: End of Survey If Are you a Portuguese National? (Different for Mexico) = No

End of Block: Screening

Start of Block: Familiarity

Q2 What is your level of familiarity with edible insects?

I consume them regularly (1)

I consume them somewhat frequently (2)

I have tried them on several occasions (3)

I have tried them once (4)

I have heard of them but never tried (5)

I have never heard of them (6)

Q3 What is your level of familiarity with foods enriched with edible insect protein? (e.g., protein bars, snacks, chocolate, bread, pasta, sports nutrition, sauces)

I consume them regularly (1)

I consume them somewhat frequently (2)

I have tried them on several occasions (3)

I have tried them once (4)

I have heard of them but never tried (5)

I have never heard of them (6)

End of Block: Familiarity

Start of Block: Adoption Questions

Q4 How likely are you to consume edible insects (Inset type, Grasshoppers for Mexico and House Cricket for Portugal) in the future?

It is certain or almost certain that I would consume (1)

It is almost certain (2)

Very likely (3)

Likely (4)

Quite likely (5)

Moderately likely (6)

Fairly likely (7)

Somewhat likely (8)

Unlikely (9)

Very unlikely (10)

It is certain or almost certain that I would not consume (11)

Q5 How likely are you to consume foods enriched with edible insect protein in the future? (e.g., protein bars, snacks, chocolate, bread, pasta, sports nutrition, sauces)

It is certain or almost certain that I would consume (1)

It is almost certain (2)

Very likely (3)

Likely (4)

Quite likely (5)

Moderately likely (6)

Fairly likely (7)

Somewhat likely (8)

Unlikely (9)

Very unlikely (10)

It is certain or almost certain that I would not consume (11)

End of Block: Adoption Questions

Start of Block: Stimuli

Q21 **This is a gourmet salad made with edible insects.** Please indicate the likelihood with which you would consume it:

It is certain or almost certain that I would consume (1)

It is almost certain (2)

Very likely (3)

- Likely (4)
- Quite likely (5)
- Moderately likely (6)
- Fairly likely (7)
- Somewhat likely (8)
- Unlikely (9)
- Very unlikely (10)
- It is certain or almost certain that I would not consume (11)

Q22 This is a smoothie mix enriched with edible insect protein. Please indicate the likelihood with which you would consume it:

- It is certain or almost certain that I would consume (1)
- It is almost certain (2)
- Very likely (3)
- Likely (4)
- Quite likely (5)
- Moderately likely (6)
- Fairly likely (7)
- Somewhat likely (8)
- Unlikely (9)
- Very unlikely (10)

It is certain or almost certain that I would not consume (11)

Q16 These are nachos/tortilla chips made with edible insect flour. Please indicate the likelihood with which you would consume them:

It is certain or almost certain that I would consume (1)

It is almost certain (2)

Very likely (3)

Likely (4)

Quite likely (5)

Moderately likely (6)

Fairly likely (7)

Somewhat likely (8)

Unlikely (9)

Very unlikely (10)

It is certain or almost certain that I would not consume (11)

End of Block: Stimuli

Start of Block: Psychographics

Disgust Rate how much you agree with the following statements:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neutral (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
<hr/>							

The thought of insects makes me nauseous (1)	0	0	0	0	0	0	0
The thought of insects makes me feel unwell (2)	0	0	0	0	0	0	0
Eating insects is repulsive (3)	0	0	0	0	0	0	0
The idea of consuming insects offends me (4)	0	0	0	0	0	0	0
If an insect crawls onto my favorite food, I won't eat it (5)	0	0	0	0	0	0	0

Neophobia Rate how much you agree with the following statements:

	Strongly disagree (1)	Disagree (2)	Somewhat disagree (3)	Neutral (4)	Somewhat agree (5)	Agree (6)	Strongly agree (7)
I am constantly sampling new and different food (1)	0	0	0	0	0	0	0

I don't trust new food (2)	0	0	0	0	0	0	0
If I don't know what a food is, I won't try it (3)	0	0	0	0	0	0	0
I like foods from different cultures (4)	0	0	0	0	0	0	0
Ethnic foods look too weird to me (5)	0	0	0	0	0	0	0
At dinner parties, I will try new food (6)	0	0	0	0	0	0	0
I am afraid to eat things I haven't had before (7)	0	0	0	0	0	0	0
I am very particular about the foods I eat (8)	0	0	0	0	0	0	0
I will eat almost anything (9)	0	0	0	0	0	0	0
I like to try new ethnic restaurants (10)	0	0	0	0	0	0	0

End of Block: Psychographics

Start of Block: Demographics

Macro-region Which region of Portugal are you from? (Different for Mexico)

Norte (1)

Centro (2)

Lisboa (3)

Alentejo (4)

Algarve (5)

Madeira/Acores (6)

Gender What is your gender?

Female (1)

Male (2)

Other (3)

Q18 What is your level of education?

No education (1)

Primary education (2)

Secondary education (3)

Upper secondary education (high school) (4)

Higher education (university) (5)

Postgraduate (master's) (6)

Postgraduate (Phd) (7)

Diet What type of diet do you follow?

- Vegetarian (1)
- Vegan (2)
- Omnivore (I eat everything) (3)
- Pescatarian (includes fish but no meat) (4)
- Other. What? (5) _____

End of Block: Demographics

Appendix B. Regional distribution by sample

	Portugal (n=121)			Mexico (n=158)	
Region	n	%	Region	n	%
Norte	16	13.2	Norte	12	7.6
Centro	13	10.7	Bajío	2	1.9
Lisboa	80	66.1	Centro	130	82.3
Alentejo	2	1.7	Sur	13	8.2
Algarve	3	2.5	Sureste		
Madeira/Acores	7	5.8			

Appendix C. ANOVA tables for Linear Regression Models

Predictor: Insect Salad

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1093.647	5	218.729	31.734	<.001 ^b
	Residual	1881.672	273	6.893		
	Total	2975.319	278			

a. Dependent Variable: EntoSala

b. Predictors: (Constant), EduLevel, Mean Food Neophobia Scale 5 items reverse coded, Nationality Differences, Idade, Mean InsectDisgust Scale 5 items

Predictor: Protein Shake

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1024.691	5	204.938	28.563	<.001 ^b
	Residual	1958.729	273	7.175		
	Total	2983.419	278			

a. Dependent Variable: EntoShake

b. Predictors: (Constant), EduLevel, Mean Food Neophobia Scale 5 items reverse coded, Nationality Differences, Idade, Mean InsectDisgust Scale 5 items

Predictor: Tortilla Chips

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1305.058	5	261.012	34.664	<.001 ^b
	Residual	2055.652	273	7.530		
	Total	3360.710	278			

a. Dependent Variable: EntoNachos

b. Predictors: (Constant), EduLevel, Mean Food Neophobia Scale 5 items reverse coded, Nationality Differences, Idade, Mean InsectDisgust Scale 5 items

Appendix D. Frequency tables for the acceptance of the most popular insect species by sample

Portugal

Acceptance of House Crickets as Food

WTC House Cricket

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	É certo ou praticamente certo que não consumiria	44	36.4	36.4	36.4
	Com muito pequena probabilidade	29	24.0	24.0	60.3
	Com pequena probabilidade	18	14.9	14.9	75.2
	Com alguma probabilidade	6	5.0	5.0	80.2
	Com razoável probabilidade	9	7.4	7.4	87.6
	Com média probabilidade	3	2.5	2.5	90.1
	Com boa probabilidade	2	1.7	1.7	91.7
	Provavelmente	5	4.1	4.1	95.9
	É quase certo	2	1.7	1.7	97.5
	É certo ou praticamente certo que consumiria	3	2.5	2.5	100.0
	Total	121	100.0	100.0	

Acceptance of Food made from House Crickets

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	É certo ou praticamente certo que não consumiria	32	26.4	26.4	26.4
	Com muito pequena probabilidade	22	18.2	18.2	44.6
	Com pequena probabilidade	17	14.0	14.0	58.7
	Com alguma probabilidade	17	14.0	14.0	72.7
	Com razoável probabilidade	6	5.0	5.0	77.7
	Com média probabilidade	9	7.4	7.4	85.1
	Com boa probabilidade	2	1.7	1.7	86.8
	Provavelmente	6	5.0	5.0	91.7
	Muito provavelmente	5	4.1	4.1	95.9
	É quase certo	2	1.7	1.7	97.5
	É certo ou praticamente certo que consumiria	3	2.5	2.5	100.0
	Total	121	100.0	100.0	

Mexico

Acceptance of Grasshoppers as Food

Probability to Consume Insects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Es seguro o casi seguro que no lo consumiria	16	10.1	10.1	10.1
	Muy poco probable	18	11.4	11.4	21.5
	Poco probable	19	12.0	12.0	33.5
	Algo probable	10	6.3	6.3	39.9
	Relativamente probable	7	4.4	4.4	44.3
	Moderadamente probable	11	7.0	7.0	51.3
	Bastante probable	12	7.6	7.6	58.9
	Probable	11	7.0	7.0	65.8
	Muy probable	19	12.0	12.0	77.8
	Es casi seguro	6	3.8	3.8	81.6
	Es seguro o casi seguro que lo consumiria	29	18.4	18.4	100.0
	Total	158	100.0	100.0	

Acceptance of Food made from Grasshoppers

Probability to Consume Insect Foods

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Es seguro o casi seguro que no lo consumiría	13	8.2	8.2	8.2
	Muy poco probable	15	9.5	9.5	17.7
	Poco probable	20	12.7	12.7	30.4
	Algo probable	15	9.5	9.5	39.9
	Relativamente probable	10	6.3	6.3	46.2
	Moderadamente probable	10	6.3	6.3	52.5
	Bastante probable	9	5.7	5.7	58.2
	Probable	16	10.1	10.1	68.4
	Muy probable	22	13.9	13.9	82.3
	Es casi seguro	9	5.7	5.7	88.0
	Es seguro o casi seguro que lo consumiría	19	12.0	12.0	100.0
	Total	158	100.0	100.0	