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Report on consumers' general interest in alternative protein food products in Mediterranean countries

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List of abbreviations

FG	focus group
FGD	focus group discussion
HSWT	Hochschule Weihenstephan-Triesdorf

Abstract

The ProxiMed project aims to introduce proteins from sustainable sources into the Mediterranean food and feed systems to promote and establish the use of alternative proteins. To ensure that consumers accept the developed products and meet their expectations, this study analysed Mediterranean consumers' general interest in alternative protein food products using a focus group study conducted in Türkiye, Tunisia, and Portugal. In the focus group study, two focused group workshops each were conducted for various food products, including pickles infused with proteins from tomato pomace and leaves, insect proteins, sesame cake and date by-products, and mycoproteins. The focus group workshops were audio recorded and subsequently analysed using qualitative data analysis methods.

The results of this study show that the general interest and awareness of alternative proteins varies between Mediterranean consumers and countries and also depends on the specific food products. Various factors influence the interest of Mediterranean consumers in new alternative protein food products, including cultural aspects or aspects related to the product. Alternative protein sources derived from familiar or traditional agricultural products such as dates can enhance the openness to innovative alternative protein products. Also, integrating the alternative proteins into popular staple food, can be a promising strategy to introduce alternative proteins into Mediterranean diets. Interest in more uncommon alternative protein sources like mycoproteins and insect-proteins differed. In the case of mycoproteins, unfamiliarity with this protein source and lack of information about such products was detected. Insect-based products evoke a range of consumers' reactions, from openness to disgust, and the appearance and presentation of the food products seem to have an essential impact on Mediterranean consumers' acceptance. Critical factors for developing marketing strategies for alternative protein food products include, for example, a carefully designed pricing strategy, considering the specific economic situation of the target market, or a mix of different communication activities. Overall, the study identified various starting points to increase the interest in alternative protein food products in Mediterranean countries and thus enhance the success of integrating alternative proteins in Mediterranean diets.

1. Introduction

The aim of the ProxiMed project, which is financially supported by the European Union, is to introduce proteins from sustainable sources into the Mediterranean food and feed systems to promote and establish the use of alternative proteins. The project focuses on a broad spectrum of alternative proteins, ranging from traditional alternative protein sources, mainly of plant origin, to chia seeds and protein sources defined as “Novel food” and agro-industrial by-products. The alternative proteins are produced using innovative and environmentally friendly processing technologies that minimize the impact on nutrients. Ultimately, it is planned to implement the researched alternative proteins into food products and adapt and introduce these to consumers in different Mediterranean regions. To ensure that Mediterranean consumers accept the developed products and that the products meet their expectations, the product development process is accompanied by consumer research. Through this, important drivers and possible cultural and religious barriers and resistances can be identified and be addressed during the product development process.

To analyse consumers’ general interests in alternative protein food products University of Applied Sciences Weihenstephan-Triesdorf, Chair of Marketing and Management of Biogenic Resource conducted a focus group study. The study focused on the three Mediterranean countries Türkiye, Tunisia and Portugal, and various alternative protein food products such as fermented vegetable pickles, Tahini, insects or mycoproteins.

For each chosen product, two focus group workshops were conducted to investigate consumers’ general interest, perceptions, relevant benefits, and barriers to integrating alternative proteins into their diets. These workshops considered different food consumption habits, eating behaviours, and cultural differences.

This deliverable presents the findings of the focus group study, primarily focusing on consumer general interests in three Mediterranean's countries regarding alternative protein food products. Based on these findings, conclusions are drawn to enhance the success of the integration of alternative proteins in Mediterranean's diets. This report is structured as follows: Chapter 2 outlines the study methodology, chapter 3 presents the key findings, and chapter 4 presents conclusions and discussions.

2. Overview of methods used

Consumers' general interest in, and perceptions of alternative proteins in Mediterranean countries were analysed using a qualitative research approach by conducting a focus group study. A focus group is a moderated discourse procedure in which a small group of individuals is encouraged to discuss a specific topic using information input (Schulz, 2012). Focus groups support understanding and explaining the meanings, beliefs and cultures which affect individuals' feelings, attitudes and behaviours. The method was chosen for this research as it is very well suited to explore food choice and dietary behaviours in the context of the lived experience of participants (Rabiee, 2004).

This focus group study consisted of different sub-studies focusing on different countries and products, including:

- pickles infused with proteins from tomato pomace in Türkiye (sub-study 1)
- insect proteins in Türkiye (sub-study 2)
- sesame cake and date by-products in Tunisia (sub-study 3)
- mycoproteins in Portugal (sub-study 4)

In each sub-study two focus group workshops were held, which were either conducted online via Zoom or in person. Participants had to be 18 years or older and be Turkish (sub-study 1,2), Tunisian (sub-study 2) or Portuguese (sub-study 3) origin. In addition, they should be at least partly responsible for their household's purchase of food products.

An interview guideline guided all focus group discussions. An interview guideline represents the operationalisation of the discussion concept of the focus group study. It includes a list of questions to be discussed with the attendees (Mack and Tampe-Mai, 2012). To guarantee comparability, a general interview guideline was developed for this study (see Appendix A: General Workshop Guideline). However, it was adapted to the specific country and product being investigated to capture the specific needs of the various sub-studies.

In addition, participants also had to answer a short, standardised questionnaire on, e.g. socio-demographic characteristics (see Appendix B: Questionnaire Group Discussion). The study's interview guideline, questionnaire and procedure obtained ethical approval from the Ethics Committee of the Technical University of Munich on May 6th, 2024.

Each focus group workshop was audio recorded and started with an introduction, in which participants were informed about the study and the study's aims. This was important to clarify the context in which the study was conducted for the attendees (Mack and Tampe-Mai, 2012). In addition, privacy aspects were clarified. Finally, consent to the procedure was obtained from the participants. Subsequently, after a quick introduction round, an information stimulus was given to participants, as the moderator introduced alternative proteins and the specific focus product of the sub-study (e.g. mycoproteins, insects). This was followed by the discussions with the participants on general interest and awareness, perceptions and preferences, specific preferences and concerns for alternative protein food products, and questions on market introduction and marketing strategies. The focus groups ended with a concluding section.

The ProXImed Consortium members offered language support collaborations to translate the needed documents and to organize and moderate the in-person workshop in Portugal.

The specific design, data collection, data preparation procedure, and analysis method of each sub-studies are presented in more detail in Chapter 3.

3. Consumers' general interest in alternative proteins products in Mediterranean countries

3.1 Consumers' interest in pickles infused with alternative protein in Türkiye

3.1.1 Study design, data collection and data analysis

This sub-study investigated consumer's interest in, and acceptance of pickles infused with protein from tomato pomace and leaves among Turkish consumers during a Master's thesis (Baltaci, 2024). For this purpose, two focus group (FG) workshops were conducted online via Zoom in August 2024 (27. and 28.08.2024), with a total of n=16 Turkish participants being responsible for their household's grocery shopping ($n_{FG1}=8$, $n_{FG2}=8$). Attendees were recruited using the non-probability convenience sampling method including snowball sampling method. Care was taken to ensure a diverse range of age groups, genders, living area, or education levels in the sample.

The two workshops followed the general interview guideline adapted to the focus product pickles and were conducted in Turkish, so that all attendees could express their thoughts comfortably. As all participants gave their written informed consent before the start, the discussions were audiotaped and transcribed verbatim afterwards. Subsequently, the transcripts were translated into English. Data was analysed using qualitative content analysis following Kuckartz (2014) systematic approach. The analysis was supported by the software MaxQDA and went through the five phases described by Kuckartz (2019): (1) Reading the data intensively, (2) building the coding frame, (3) coding the data, (4) analysing the coded data, (5) presenting the results. Both deductive (concept-driven) and inductive (data-driven) coding were used. A predefined coding frame deduced from the interview guideline, literature research, and research questions was the starting point of deductive coding. In addition, inductive coding was used, when new themes emerged directly from the data. During this process, the researcher went over the transcripts several times to identify all new themes and refine them until saturation was reached.

3.1.2 Summary of the results of consumers' general interest in pickles infused with proteins

The results of sub-study 1 are summarized in the following based on the Master's thesis of Baltaci (2024).

Eight men and eight women participated in the focus groups (see Table 1); 56% of the attendees were 40 years or younger, while the rest were older than 40 years. In addition, around 70% had a University degree (Bachelor's or higher), and more than 80% came from urban areas.

Table 1. Description of the sample (pickles, Türkiye)

		n	%
Gender	male	8	50%
	femal	8	50%
Age Group	18-25 years	4	25%
	>25-40 years	5	31%
	>40 years and older	7	44%

Source: Baltaci (2024)

General interest and awareness

At the beginning of the workshops, participants were asked to share their initial thoughts and impressions when hearing about alternative protein food products in general. The attendees shared a wide range of associations, as some spoke about specific products. In contrast, others brought up specific topics like the type of diet or the degree of processing of food products.

Some of the participants associate alternative proteins with products typically used by athletes or in supports nutrition, such as protein bars or protein enriched milk. Others connected the term to vegan or vegetarian diets and thus to plant-based substitutes of traditional animal products.

Also, misconceptions or hesitations came up during the discussion. For example, one person associated the term with alternative medicine, which was not regarded as scientific. Other attendees spoke about the processing degree, as they linked alternative proteins to processed foods. In contrast, there was also one person who was curious and open to trying alternative proteins if the products provided benefits, for example, in terms of health.

Next, the discussion turned to prior experiences, or instances where the participants came across alternative proteins. However, prior experience was limited as various attendees noted that they had not come across or tasted alternative protein food products before. This indicated a general unfamiliarity with this type of products among the workshop participants.

Subsequently, the question was raised about how alternative protein food products could fit into one's current diet or lifestyle. The discussions showed mixed reactions on this issue. Some attendees were curious and open towards alternative protein food products, while others expressed practical concerns or cultural preferences, resulting in difficulties integrating such products into their diets.

One participant was very interested in the concept of alternative proteins because of a perceived lack of sufficient protein intake in the current diet. Also, a long-term vegetarian raised concerns regarding protein deficiency when following a specific diet. Others had the feeling that alternative protein food products are a valuable option to meet the protein needs in countries like Türkiye, where traditional protein sources are sometimes expensive or not accessible.

Others pointed out that lifestyle changes can be important in forming willingness to try alternative protein food products. For example, one attendee reported that when moving from the home city where he lived with the family to another city where he lived alone, the dietary habits significantly changed. In this respect, attendees also discussed the effect of urbanization and convenience orientation, noting that in urban areas, there are many convenience-driven buyers and users of alternative proteins.

In contrast, other attendees were sceptical about integrating such products into their current diet and instead stressed the importance of maintaining traditional dietary habits. For example, one attendee remarked to prefer the unprocessed traditional protein source (here: "chickpeas") compared to a processed product containing the traditional source. In this respect, also a preference for plant-based products from their own hometown was raised, compared to buying such products from the market. Others reported similar conservative views regarding diet or nutrition, for example, being not open towards trying something new.

Perception and preferences

The next part of the workshop began with the question of which factors influence the decision to try new foods. Participants discussed several significant factors in this regard. Health-related aspects turned out to be a very important influencing factor. However, there were also mixed views on this. While some emphasized that when selecting new food products, it is most important to them that the products are healthy, others were more reserved. They argued that health claims are often interesting initially, but do not automatically lead to continuing consumption. Others also reported that health claims can raise their willingness to try a product, but only if they are reliable. Another important influencing factor raised by the attendees was the taste of the product. Participants reported that especially when trying a product for the first time, a delicious taste is crucial. Moreover, costs are important, and attendees emphasized that in the Turkish market, new products must necessarily be affordable. A further important influencing factor is accessibility. This aspect was raised

by people living in rural areas with more limited access to new products, but also discussed by younger people living in urban areas, who demanded that accessing such products should be convenient for them. Younger participants also discussed that new products must be practical and convenient given their modern, fast-paced lifestyles. In addition, several minor points were raised in the discussion. These points included a need for reliable brands, good marketing to build trust in new products, and the need for transparent production methods for new products.

Subsequently, the discussion turned to how participants perceive the health benefits of alternative protein food products compared to traditional protein sources. Here, various views were raised. One attendee spoke about the potential benefits of plant-based proteins, which were regarded as being easier to consume and more accessible in Türkiye. Due to this, it was suggested that plant-based proteins should be more important in Turkish diets, given their health benefits and cultural compatibility. Another attendee felt alternative proteins were an essential and practical answer to obtaining important nutrients in concentrated forms.

In addition, the negative effects of consuming animal proteins in large amounts were also discussed. For example, one participant noted indigestion and discomfort after eating large quantities of animal protein. In contrast, others noted that plant-based and traditional animal proteins have their own role in a balanced diet. Despite, also concerns were raised about whether alternative protein food products could really fulfil nutrient requirements.

Afterwards the discussion turned to cultural and social influences that might impact the acceptance of alternative protein food products. The discussion on this showed that it is essential that alternative protein food products conform to traditional Turkish cuisine. Attendees highlighted that the acceptance of such products is more likely if they have familiar tastes, flavours, and ingredients. Moreover, it was noted that the visibility and exposure of these products in everyday lives of individuals are important. For example, seeing a product regularly in stores or advertisements enhances the willingness to try it. However, advertisement, especially on social media, was also a controversial point, as various attendees reported suspiciousness toward social media marketing. Despite this, attendees preferred more reliable information sources, like word-of-mouth recommendations such as product reviews or advice from professionals like their own physicians.

In the last part of this section, participants should explain how concerned they were about the environmental impact of the food products they consume. The discussion showed that concerns about environmental impact differed among the attendees. Some participants reported that sustainability aspects play a significant role in their dietary choices by particularly trying to decrease the consumption of animal-based products such as red meat. For other attendees, it was important to implement environmentally friendly behaviours in their everyday lives, for example, by reducing waste or disposing of waste properly. Other participants connected sustainability to the efficient use of resources, for example, by considering products made from waste or by-products. However, it was also explained that, for practical reasons and due to individual lifestyle habits, it is difficult to always harmonise one's actions with environmental values. Despite this, some attendees also expressed a lack of concern regarding environmental issues, noting that they did not prioritize environmental impact in their food choices.

Specific preferences and concerns for alternative protein food products

The next section of the workshops discussed specific preferences and concerns for pickles infused with protein derived from tomato pomace and leaves. Firstly, attendees were asked if they would be willing to try alternative protein food products derived from tomato and pomace leaves and the reasons for this. Overall, participants were open to pickles infused with protein derived from tomato pomace and

leaves. In addition, various people were curious and enthusiastic about such products. The discussions also showed that pickles were a significant component of many attendees' diets, indicating that traditional food products can act as a promising carrier for food innovations. But despite of this, other participants emphasized that they only eat homemade pickles, indicating that making pickles at home is a deep-rooted tradition in many families.

Next, participants were asked to report what factors would make them more likely to purchase pickles infused with protein derived from tomato pomace and leaves. While many respondents were open to pickles with added protein, it was also very important for them that the alternative protein product offers the traditional taste and appearance of pickles. Due to this, they were very reserved about altering the familiar taste and shape of pickles and expressed concerns about how the added protein would modify the pickles' flavour. Overall, the discussion also highlighted the importance of an enjoyable taste of the new product. Further, it was also explained that the primary purpose of pickles should not be changed. Moreover, health-related aspects are a further factor influencing the buying decision, as attendees demanded that the product should be healthy and free from additives. Also, safety concerns were raised in the discussion; for example, participants noted the importance of sterilization of such products. For others, the source of the added proteins was important, as they were against adding synthetic proteins. A good accessibility was a further factor reported to influence willingness to purchase pickles infused with proteins. Lastly, some respondents also noted that informative packaging with claims and ingredient details influences purchasing decisions. Lastly, an acceptable price is important.

Next, preferred flavours, textures and preparation methods for protein-infused pickles were discussed. While various personal preferences were reported here, many attendees reiterated that providing the traditional taste of Turkish pickles is very important. Also, one participant reported disliking international influences, for example, from Asian cuisine, on flavour. Thus, the discussion highlighted again that innovative protein-infused pickles must maintain traditional flavours. Besides this, the discussion showed that there were differing preferences for the spiciness in pickles among the attendees, with some liking spicy pickles and others disliking them. Due to this, participants advised that providing a spectrum of flavours and forms might increase the attractiveness of pickles infused with proteins. Lastly, one participant thought it would be a nice idea, when the protein derived from tomato pomace and leaves could be added to home-made pickles.

Marketing strategies for alternative protein food products

The last section of the workshops discussed aspects regarding market introduction and possible marketing strategies. Firstly, attendees were asked to describe how they usually discover new food products in the market. Participants highlighted that personal recommendations, for example, from trusted people like family or friends, are decisive in discovering new products. This shows that word-of-mouth is significant for product discovery. However, another participant noted that in the case of innovative products, which are not known by related people, expert endorsement of health professionals is important. In contrast, the same person has considerable reservations regarding recommendations of influencers or other famous people, such as show stars. Additionally, participants also discussed (repeated) exposure to the products as important for discovering new food products. For example, one attendee frequently discovered new products while shopping, e.g. when the product is placed in a prominent position in the first aisle. Also, the importance of advertisement was named in this respect. Moreover, several participants emphasized the role of television or social media advertisements as a significant factor in raising awareness and influencing purchasing decisions.

Asked what marketing strategies would effectively capture one's attention and interest in alternative protein food products, participants discussed varying views. Again, attendees emphasized that honest and transparent product presentation is important and that embellishing claims could be a sign of problems with the product. The use of health claims was evaluated controversial, too. One attended liked the idea of emphasizing health benefits of alternative proteins and found it incredibly appealing, when the products would be marketed as a kind of medicine for problems caused by animal proteins (e.g. indigestion). In contrast, other participants were firmly against promoting alternative proteins as a kind of drug. A further topic that was raised in the discussion was the amount of information given about the production of the products. In this respect, some participants noted that the product's content must indeed be clear, but the production background should be partially hidden to prevent unneeded preconceptions. Lastly, several participants emphasized again, the importance of repeated exposure to the alternative protein food products, for example in stores or through advertisements, to capture attention and interest.

Finally, the discussion turned to specific channels or platforms where participants preferred to receive information about food products. Here, a spectrum of preferences came up. However, a dominant topic was user reviews. Several attendees emphasized that reading consumer comments online is important for making informed choices. Others reported that they prefer to counsel trusted persons who are perceived competent in their fields. Specifically, in the case of new products, attendees were also interested in elaborated product websites. In addition, social media platforms like Instagram were mentioned as possible channels for information. However, some attendees also expressed scepticism about influencer marketing. The discussion showed that the selection of influencers is a critical point here, as participants were averse to influencers which were from unrelated fields.

3.1.3 Conclusions regarding consumers' interest in pickles infused with proteins in Türkiye

The analysis of the discussions showed that Turkish consumers are willing to try alternative proteins. However, acceptance is strongly affected by factors like cultural familiarity, taste, cost and trust in the product. As pickles are a popular staple food in the Turkish diet, they could be a promising product to introduce alternative proteins to Turkish cuisine. However, a precondition for success seems to be that the infused products meet traditional expectations for taste, quality, and transparent marketing. In addition, participants were also concerned about the unfamiliarity of alternative proteins and sceptical towards health claims, which is a challenge for the introduction of alternative proteins in the Turkish market, where traditional food practices are highly valued. The discussions also showed that participants valued the sustainable use of by-products like tomato pomace and leaves. However, they also expressed reservations about how practical it would be to integrate these innovative food products into their everyday routines, especially regarding convenience, cost, and flavour (Baltaci, 2024).

3.2 Consumers' interest in insect protein in Türkiye

3.2.1 Study design, data collection and data analysis

In this sub-study, which investigated Turkish consumers' interest in and acceptance of insects as an alternative protein source in Türkiye within a Master's thesis (Atay, 2024), two focus group workshops were conducted online via Zoom in June 2024 (15.06.2024 and 22.06.2024). A total of $n=15$ Turkish participants ($n_{FG1}=7$, $n_{FG2}=8$) were recruited using the non-probability purposive sampling method, taking age, gender, occupation or education level into consideration in the recruitment process.

The discussions were in English, were moderated by the researcher and lasted approximately 90 minutes. All participants gave their written informed consent and were rewarded with a 5 Euro Amazon voucher for participation. The discussions were recorded. In addition, the researcher took notes.

After the workshops, the recordings were transcribed, and the software MaxQDA was used to perform qualitative data analysis and systematically code and categorize the data. Visual coding tools, thematic maps and word frequency analyses offered in MaxQDA were used to examine the data in-depth and identify patterns among the answers.

3.2.2 Summary of the results of consumers' general interest in insect protein

This section summarizes the results of sub-study 2 based on the Master's thesis of Atay (2024).

Among the attendees were nine men and six women, and the majority (60%) was between 26 and 40 years old (see Table 2). Most participants (33%) lived in a 2-persons household, around 27% in a single-person household, and the rest lived in bigger households. All participants stuck to an omnivorous diet. In addition, one individual commits to halal food and beverages. The preferred shopping place among the interviewees was supermarkets.

Table 2. Description of the sample (insects, Türkiye)

		n	%
Gender	male	9	60
	female	6	40
Age Group	18-25 years	2	13
	>25-40 years	9	60
	>40 years and older	4	27

Source: Atay (2024)

General interest and awareness

The focus group discussions started with participants sharing their initial thoughts and impressions when hearing about alternative protein food products in general. Here, various alternative protein sources were mentioned, including plant-based sources, artificial sources and most frequently insect proteins. In addition, a spectrum of emotional responses to alternative protein sources was observable, for example, a feeling of disgust towards insect protein sources on the one side and curiosity and openness on the other. Moreover, several motivations and needs were raised in this initial phase of the workshops. This contained health needs, sustainability concerns, economic factors, and population growth. Further, cultural and geographical aspects were raised. For example, one participant noted that meat consumption habits differ between Eastern and Western parts of Turkey. Moreover, the importance of different forms, textures, appearances and tastes of alternative protein sources was discussed.

Next, respondents were asked to report experiences or instances where they have come across alternative protein food products. The discussion showed that the experiences with alternative protein food

products varied. Some attendees mentioned ambivalent experiences abroad, like, for example, experience with eating bugs in Mexico. Others spoke about the current situation in Turkey, noting that alternative protein food products are limited and not widespread in the Turkish market, with Tofu being the only source that was ever seen. Other participants added that alternative protein sources are expensive and only available in special stores in Turkey. It was also apparent that the level of knowledge about different alternative proteins sources varied among the participants. So, some could give examples of several different plant-based proteins sources, while others were less knowledgeable.

After talking about their experiences, participants were asked how alternative protein food products could fit into their current diet or lifestyle. Most attendees did not want to adopt alternative protein food products entirely and instead tended to supplement their current diet with them. The discussion also brought up several barriers and concerns regarding adopting alternative protein food products. Firstly, cultural and religious aspects were identified as significant barriers, particularly in the case of insect-based proteins. For example, one respondent explained that eating insects is not part of Turkish culture and that eating most of the insects was forbidden for Muslim people. Other attendees expressed health concerns about consuming insects. Further, economic factors and time constraints were raised as barriers to adopt alternative protein sources. For example, one person, still a student, noted the large price difference between traditional and alternative protein sources and the time needed to prepare alternative protein sources. In addition, several attendees had concerns regarding taste and texture. Also, different preferences regarding the processing degree of alternative protein food products became apparent, as some wanted less processed and others more processed and incognizable products. The latter was especially true in the case of products based on insects. Despite this, the discussion also brought up several factors which could enhance the adoption of alternative protein food products. These included health aspects, environmental concerns, and the search for novelty.

Perceptions and preferences

Next, the discussion turned to factors most important for participants when trying new foods. Sensory properties were mentioned most frequently in this regard. A delicious smell turned out to be essential for many respondents, but appearance and taste are also significant. Moreover, preparation and ingredients are significant factors when trying new foods. For example, one attendee mentioned that the cooking method is critical as many Turkish people prefer to cook foods in small pots. Another noted aspect was that one person continuously checks the ingredients when eating new foods in restaurants. In addition, cultural and religious are important, as one participant who sticks to Islamic rules emphasized that he cannot eat forbidden foods, even when it looks and smells good. Others mentioned the role of social influences, as they strongly rely on recommendations when trying new foods. Also mentioned, but only from single persons, were health and hygiene concerns when dining out and preferences for certain types, such as plant-based foods.

Several aspects emerged when discussing which cultural or social influences might impact respondents' acceptance of alternative protein food products. An important social influence mentioned was the influence of family. Here, it was noted, for example, that regarding eating preferences, there sometimes exists a generation gap between the older and younger members of a family, with the younger being sometimes more open-minded. However, one younger participant also mentioned being conservative in terms of food. Respondents also emphasized that traditional food habits and cultural differences influence acceptance. This aspect was illustrated using the example of Mumbar and Şırdan, traditional Turkish food products which might not be accepted in other regions or countries, according to one participant. Another respondent highlighted the influence of religious requirements, which can have a strong effect on the acceptance of new food products, especially if the products do not meet these requirements. Another attendee noted that living abroad can also change acceptance of alternative protein food products. Further, also personal attitudes were identified as factors influencing acceptance.

After this general discussion of factors influencing respondents' acceptance of alternative protein food products, the discussion turned to the compatibility of insect-based foods with Turkish culture and possible conflicts. The most often mentioned aspect in this regard were hygiene and health perceptions, as insects were evaluated as dirty by many participants. Further cultural perceptions and habits were raised, as one participant explained that Turkish people always hunt insects and were not taught to eat them. Further, the religious and traditional aspects were mentioned here again, as respondents explained that if Turkish people do not eat ham, they certainly will not eat insects. In addition, product features and presentation were discussed. Here, attendees highlighted the shape of the new products, explaining that if the new product does not resemble the original, it is probably better accepted. Further economic factors were raised, as people accept insect-based foods probably better when they are cheap.

In this section, the environmental impacts and nutritional benefits of alternative protein food products were discussed with the attendees, too. A number of participants expressed sustainability concerns. Alternative protein sources were regarded as environmentally beneficial in this respect. Further, participants discussed ecological balance, mentioning that insects play a significant role in the ecosystems by, e.g. carrying pollens. Also, the industrial production of traditional animal protein like chicken meat was criticised in the context of the discussion of the environmental impacts. Concerning nutritional benefits, the discussion was controversial. While some participants mentioned positive nutritional benefits when eating insects, such as the availability of specific amino acids, others reported negative nutritional impacts (e.g. reduction of certain vitamins' absorption).

Specific preferences and concerns

Next, the discussions turned to respondents' specific views on alternative food products based on insect protein. Most of the attendees were willing to try insect-based foods. However, they also defined certain preconditions and preferences for consuming of such products. First, some said that they would try it but only eat it sometimes and not constantly. Another precondition was an acceptable smell and taste. Further, the products' form was discussed as important for the willingness to try, with several attendees stating that they could only eat insects-based food in powder or capsule form. Another one would try cheese based on insect protein, but only if this was produced under hygienic conditions. In addition, others emphasized that Turkish people could accept insect-based food when it fits the Turkish culture and does not change the taste of traditional products. For example, the attendee mentioned that eating the insect protein with yoghurt might be fine for people.

In addition, attendees mentioned several aspects that make them more likely to purchase food products based on insects. In this regard, economic factors were highlighted as respondents emphasized

that the product's price was important and that the product had to fit the budget. Regarding nutritional value, the price-performance ratio (that is, protein content per Euro spent) is important for other participants, with a higher price-performance ratio enhancing the purchase probability. Further, availability was reported to impact the purchase decision, and the attendees demanded that the product be available at their supermarket. Lastly, one participant emphasized that the necessity to consume the product affects the likelihood of purchasing it by saying that he would only eat insect-based food when there is nothing else on the table.

Lastly, respondents were asked if any specific flavours, textures, or preparation methods would enhance their enjoyment of insect-based food products. The discussion revealed that familiar sensory qualities are important, as one interviewee wanted a scent that reminded them of their childhood. Others could imagine a snack-like format, such as a protein bar. Further respondent stated that they prefer a powder form. In addition, other consumption-related aspects were mentioned: For example, it was said that such products would be tried when they are offered in top-class restaurants. In addition, the importance of early contact with such products, for example, in childhood, as well as recommendations from trusted people, were mentioned.

Market introduction and marketing strategies

In this section of the workshops, respondents were asked how they usually discover new food products in the market and what marketing strategies would effectively capture their attention and interest in alternative protein food products. Social media platforms and influencers were the most mentioned means to discover new products. Further mentioned ways to discover new products, were market brochures and supermarket promotions. Also, recommendations from close persons, such as friends, play a role in this respect.

To promote alternative food products, one respondent emphasized that the permission of religious authorities, such as the Directorate of Religious Affairs in Türkiye, is essential. Other attendees recommended pursuing a low-price or even free trial strategy, especially in the market introduction phase.

3.2.3 Conclusions regarding consumers' interest in insect proteins in Türkiye

The discussions showed that Turkish consumers show various reactions to alternative proteins from insects, ranging from disgust to curiosity and openness. Cultural habits and religious beliefs are essential for consumer acceptance, as, for example, concerns were expressed in terms of the compatibility of protein from insects with Turkish culture as well as halal certification of food. However, some attendees also supposed that alternative protein sources may be environmentally sound, while others were concerned about the hygienic aspects and potential health effects of insect-based food. The workshops also demonstrated that the appearance and presentation of insect-based foods strongly affect consumer acceptance: Better accepted are forms that do not resemble the original insect form. A further important influencing factor reported in the discussions was price, which should be affordable for the consumers. Social media and influencer marketing, as well as permission from religious authorities were identified as promising means to promote alternative protein food products (Atay, 2024).

3.3 Consumers' interest in Sesame cake and date by-products in Tunisia

3.3.1 Study design, data collection and data analysis

This study explores consumer acceptance of protein-enriched modified foods, specifically sesame cake and date by-Products as an alternative protein source in Tunisia as part of a master's thesis (Tauber, 2024). Two focus group discussions (FGD) were performed online via Zoom in June 2024 to address this objective, each lasting approximately two hours. The study included 13 Tunisian individuals who lived both in Tunisia and overseas. The only strict criterion was Tunisian origin, regardless of current residences ($n_{FG1}=7$, $n_{FG2}=6$).

Participants were recruited using a combination of personal outreach and snowball sampling. Efforts were made to ensure diversity in age and gender within the sample (Moser and and Korstjens, 2018). The workshop program was with a semi-structured interview guide on recognized qualitative research principles (Moser and and Korstjens, 2018, O'Brien et al., 2014, Patton, 2005, Tong et al., 2007). The guideline was structured from top to bottom, starting with broad questions regarding personal food consumption patterns and protein awareness and moving towards more specific topics of factors influencing the acceptance of alternative proteins.

The discussions adhered to qualitative research protocol (O'Brien et al., 2014, Patton, 2005) and a structured interview guide. Participants gave informed consent, preserving confidentiality. The sessions started with an overview of the study, followed by a participant introduction and an icebreaker. After explaining alternative proteins, the moderators asked participants open-ended questions about their consumption habits and protein intake. The focus group discussions were recorded via Zoom and afterwards transcribed. The transcripts were subsequently reviewed and cleaned manually to ensure accuracy and to anonymize the data. The transcriptions were prepared following the basic transcription rules outlined by Dresing and Pehl (2015).

The qualitative content analysis was conducted using MaxQDA to code and categorize transcribed focus group discussions. An initial interview identified key themes, which were coded using a combined deductive and inductive approach (Kuckartz, 2012, Moser and and Korstjens, 2018). Following Rädiker and Kuckartz (2019), the analysis proceeded through familiarization, category development, coding, aggregation, subcategory refinement, and final category-based interpretation. Coded data were analysed for patterns and thematic relationships, contextualized within the literature, and structured into three sections: current food culture and consumer decision-making, perceptions of new foods and alternative proteins, and integration possibilities and market introduction, providing a structured overview of the data.

3.3.2 Summary of the results of consumers' interest in same cake and date by-products in Tunisia

The results of sub-study 3 are summarized in the following based on the Master's thesis of Tauber (2024).

Of the 13 participants, three were male (23%), and ten were female (77%) (see Table 3). The age distribution showed that the majority (46% were between the ages of 30 and 45 years, followed by those between the ages of 15 and 18 years (39%), and those between the ages of 45 and 60(15%). Regarding their current residence, the majority (69%) were in Tunisia, followed by Germany (15%), France 8% and Spain 8%.

Table 3. Description of the sample (Sesame cake and date by-products, Tunisia)

		n	%
Gender	male	3	23
	female	10	77
Age Group	15-30 years	5	39
	>30-45 years	6	46
	>40 years and older	2	25

Source: Tauber (2024)

Food consumption patterns and consumer decision making in Tunisia

This section explores the factors shaping consumer food choices in Tunisia, including individual consumption patterns and broader socio-cultural influences.

Current food Culture

Participants emphasized the importance of meat, fish, and fresh products in traditional Tunisian cuisine, leading to a high animal protein intake. They noted that most meals include some form of animal protein. At the same time, vegetables and plant-based foods are often paired with these proteins. One participant shared a story highlighting this sentiment.

"We say that if you are eating lunch or dinner and it does not have meat, then there is something missing. You know, it is not a full, it is not a complete dish if you do not put meat in." (Transcript 2, P10, 00:17:15)
"We do eat a lot of vegetables. We do eat a lot of [incomprehensible] not just like meat meat meat, but it is hard to find a dish without meat. Even without meat or chicken, it must have eggs in the middle, like Shakshuka or Tuna. (Transcript 2, P8, 01:10)

Meat holds cultural significance, with some feeling a meal is incomplete without it. Overall, Tunisia's consumption patterns are centred around animal proteins, resulting in a high protein intake.

Special diets and adjustments for health reasons

Individuals on special diets, particularly vegetarians, paid more attention to their protein intake than those on traditional diets. They focused on meeting nutritional needs without meat, often using legumes, grains, and occasionally supplements. These participants emphasized their heightened focus on meeting their nutritional needs without consuming meat. This becomes clear from several comments made:

"Because I'm not like a big meat eater, so I need to constantly think, where am I going to get my proteins from." (Transcript 1, P3, 00:14:04)

Several participants mentioned focusing on legumes and grains, but only one stated that she sometimes uses protein supplements like protein powder or protein bars to meet daily protein needs. Moreover, participants on specific diets seemed more likely to combine different protein sources to obtain a complete amino acid profile, a complexity not as commonly considered by those who rely on "automatically" consuming enough proteins through traditional diets.

Overall awareness of protein consumption

When asked about protein intake, participants showed varying levels of attention. Most agreed that traditional Tunisian cuisine naturally provides ample protein, so they do not actively track it, trusting the diet's sufficiency. Participants noted the following:

"So usually, I don't really pay attention to the quantity of protein, because I consider that our style of the food, that we usually have in general in Tunisia, already has a good quantity of protein, because we eat a lot of meat and fish." (Transcript 1, P5, 00:16:21)

"I don't take attention of the quantity of protein, because Tunisian kitchen offers a variety of delicious dishes rich in protein, like couscous with meat or fish like Ojja [Tunisian egg dish], so in every meal we have protein, but we don't take attention of the quantity of the protein." (Transcript 1, P1, 00:21:22)

Overall, while the majority relied on the protein content of traditional Tunisian meals, those with specific health goals or dietary restrictions were more likely to pay closer attention to their protein consumption, using both traditional plant-based sources like couscous, lentils, and alternative sources like protein powder to ensure adequate intake.

Consumer decision making

Participants highlighted key factors in their purchasing decisions: price, convenience, and trust in familiar brands. Affordability was crucial, mainly due to inflation, while convenience and ease of preparation were also important. Trust in local producers and the influence of social media marketing were additional factors in their choices. Several participants also discussed the influence of marketing via social media and promotional information on their buying decisions.

"I would always buy the products from local markets and not from supermarkets like Geo or Carrefour or Monoprix. Local sort of producers has better fresher products," (Transcript 1, P3, 00:52:53)

Health benefits were paramount for many, with participants prioritizing foods that contributed to their overall well-being as one participant explained. Taste and texture were other significant factors mentioned. Quality and freshness were also mentioned several times, as participants preferred fresh and high-quality foods, perceiving them as healthier and more satisfying.

Participants discussed sustainability in their purchasing decisions, though it was not initially a primary focus. Many considered the environmental and social impact when given the choice, preferring sustainably sourced products like organic eggs. Some, especially ecologists, emphasized eco-friendly and ethical production. They also stressed the need for transparency on product origins to make informed, sustainable choices, noting that a lack of information often hinders their efforts, as one respondent described.

"I would, of course, if I had the choice, I would choose something that respects the environment. The problem is how much information is available." (Transcript 1, P4, 00:55:06)

One participant also mentioned different awareness levels in Tunisia compared to Germany (where she currently lives), stating:

"I am just comparing Germany to Tunisia, for example, if you buy something in Germany and it says that you are contributing to less CO₂, or you are, you know, helping with something, you are reducing waste, people will take it and be proud of it, right? But in Tunisia, they do not really care about what

they are contributing to. It is more about what this product is contributing to my health, what this is doing, how is it a plus to me." (Transcript 2, P10, 01:05:14)

Socio-cultural factors

Participants emphasized the cultural association of meat with a complete meal and a strong preference for local, fresh ingredients from markets, which are seen as superior to supermarket options. Traditional Tunisian meals typically include meat or fish, and meals lacking these are often considered incomplete. Dates and sesame were highlighted as culturally significant and consumed daily reflecting their cultural relevance and trust among participants. These ingredients are consumed almost daily and are special in Tunisian food habits. Multiple comments from the focus group illustrated this:

"The dates, for example, also are a big part of our, of our habits. Like I don't, I don't remember that there is any day in the year that we don't have dates at home, so it's a big part of our habits also." (Transcript 1, P5, 00:16:21)

"Because even our grandmothers are aware about the importance of, for example, sesame or the use of sesame and dates in our breakfast. And, for example, when I had my baby boy, I had all the advices to use grounded sesame for the baby in all his first meals. So, there is an awareness about the importance of the use of sesame and the dates, [...]" (Transcript 2, P11, 01:13:07)

Resistance to new ingredients and changes to traditional preparation methods was seen as disrespectful. Despite the attachment to traditional proteins, there is growing interest in alternative proteins, provided they align with Tunisian culture. One participant noted the potential for integrating alternative proteins into traditional diets while emphasizing the importance of making it necessary to fit with the culture and traditions of Tunisians; one participant stated:

"So, there is an awareness about the importance of the use of sesame and the dates as a source of protein, but when we think about products that could replace our protein alternatives, we should be conscious about the habits of Tunisian consumers to introduce these alternative protein products. So, we should introduce something that can fit perfectly with the traditional habits of Tunisian culture of the consumers." (Transcript 2, P11, 01:13:07)

Religion was not a significant theme, but a comment like "We do not eat pork" reflects Islam's influence in Tunisia, where certain foods, like pork, are avoided due to religious guidelines.

The other particularly key factor the participants raised was families and social influences, which play a key role in shaping food choices, reinforcing traditional dietary patterns, and introducing new habits. Participants highlighted the influence of family advice, like grandmothers recommending sesame and dates for health benefits. Cultural and familial expectations create challenges for those reducing meat consumption. Social circles, such as friends and roommates, also impact dietary habits, with some adopting vegetarian or vegan diets due to peer influence.

"So if a member of your family or your friend told you this thing is good, you can trust him or her more than marketing or any other source of information." (Transcript 2, P8, 00:59:19)

"So for the health benefits, I think it has to be supported by like studies or opinions of people, because in Tunisia we are very emotional people, so we trust each other more than science maybe." (Transcript 2, P8, 00:59:19)

In Tunisia, personal recommendations from family or friends are trusted more than marketing or scientific studies, highlighting the strong role of social networks in food choices.

Participants highlighted the deep-rooted food habits in Tunisian culture, making changes to traditional diets, like introducing alternative proteins, a challenging activity. They emphasized that any deviation from dietary norms is hard to accept. New products must align with traditional habits and cultural preferences to be embraced.

"So, there is an awareness about the importance of the use of sesame and the dates as a source of protein, but when we think about products that could replace our protein alternatives, we should be conscious about the habits of Tunisian consumers to introduce these alternative protein products. So, we should introduce something that can fit perfectly with the traditional habits of Tunisian culture of the consumers." (Transcript 2, P11, 01:13:07)

A participant emphasized the need for new products to align with traditional habits and cultural preferences, stating. In summary, the strong food habits in Tunisia are characterized by a deep-rooted adherence to traditional dietary patterns and a significant resistance to change.

Age influences dietary habits, with younger people more interested in healthy eating and new diets, while older generations tend to stick to traditional diets. Gender perspectives vary, with some noting men's greater focus on protein for sports, while others see awareness as growing among both genders; one participant noted:

"If you go to the young people, to the young generation, they are aware of it [the vegetarian diets]. But they cannot find the products. There's no one producing like these plant protein-based products in Tunisia. So they have nothing to do but to eat, like the traditional, you know, protein source. But as I said, if you go to the old generations, like, I don't know from like my father's and etc., they would not accept it actually, for [incomprehensible]." (Transcript 2, P10, 00:29:49)

Regional differences in Tunisia affect food choices, with urban areas having more diverse products and rural regions showing conservatism and less variety. The north and south of Tunisia also differ, with the south consuming more meat and less fresh fish.

Perceptions of New Foods and Alternative Proteins

Facilitators and barriers regarding the acceptance of alternative proteins

During the workshop participants listed three words about alternative proteins derived from sesame or date by-products. Responses, organized into topics, identified health, sustainability, flavour and application as significant concerns (see Table 4).

Health benefits were named as a primary motivator for considering alternative proteins, especially when these products are designed to replace unhealthy components in traditional diets. Two participants explained,

"So I think from the healthy point of view, it will be better to consume protein alternatives, because it contains also all the benefit compounds. So if I will consider consuming these alternative proteins, it will be focusing on the health point of view, or health benefits, that will attract me to try these products." (Transcript 2, P11, 01:00:41)

Participants indicated that emphasizing these benefits on packaging could be more effective than merely stating the protein content. On the other hand, concerns regarding processing, additives, and long-term

health effects also emerged. There was a significant emphasis on the need for scientific validation and transparency regarding health benefits.

Table 4. Categorization of individual task responses

Health (#10)	Sustainability (#10)	Taste & application (#9)	Nutrition & function (#3)	Price (#3)	Innovation (#2)	Local context (#2)
Healthy x5	Sustainability		Healthy x 5	Sustainability		Healthy x 5
Health x2	Sustainable x2	Nice recipes	Energy	Price	Possibility	Tunisia
Healthy food	Sustainably produced foo[d]	Delicious	Processed	Price		
Healthy alternative	Ecological food	Snacks				
Safety over longterm	Waste valorisation	Biscuits				
	Valorisation	Cakes				
	Impact	Yogurt				
		Sweet				

Source: Tauber (2024)

Production process and ingredients

Participants favoured less processed alternative proteins made with natural components, citing concerns about additives and production transparency. One participant noted,

"For the alternative proteins originated from plants or vegetables or grain of sesame or date or etc. it depends, as the ladies said before me, it depends on the additive and the composition of the final product. So, if it is a minimally processed product, just one two steps of processing, drying, milling and that's all just enrichment or just a mix of something, it's okay, but if I will see in the ingredient, all these additives, starting with E and some conservative and this unnamed, unknown additive, personally, I will not consume it." (Transcript 2, P13, 00:40:11)

Concerns about additives were prominent, with participants expressing scepticism about products containing unfamiliar or numerous additives. As one participant stated,

"If you have a package of [protein] powder of like dates and you say it's 100% made of dates, then everyone would buy it. But if you add like, many stuff to it, then it is hard for Tunisians to trust it." (Transcript 2, P10, 00:32:53)

The importance of freshness was another key theme, with participants expressing a preference for fresh products and scepticism toward highly processed foods. Trust in local and homemade products was significant, as these were perceived to be higher quality and more trustworthy. Participants also highlighted the need for transparency in the production process and clear information about manufacturing conditions and ingredients.

Familiarity

Familiarity with the ingredients promotes acceptance of alternative proteins. Participants trusted traditional ingredients such as dates and sesame, which are considered cornerstones of Tunisian cuisine. As one participant stated,

"And for dates and sesame, we're really familiar with it. As I said, we have already many sweets and products with it. So we like the taste and we trust it. So we would trust new products with these flavours, but not, I think, completely replace meat or protein intake sources." (Transcript 2, P12, 01:09:13)

"For me, I love sesame, and I love dates, so I think that I have no problem to try these alternative proteins." (Transcript 1, P5, 01:03:11)

Generally, Participants were willing to try novel foods manufactured with known ingredients such as dates and sesame, valuing their taste and trust. They liked local ingredients but were cautious about by-products or strange forms.

Acceptance of by-products as a source

Despite some scepticism regarding the unfamiliarity with by-products, participants demonstrated a general openness to using by-products from sesame and date processing as sources of alternative proteins if these products are natural and contain minimal additives. One participant stated,

"Yes say, for example, you want to exploit the rest, like of the sesame and the dates, if you just, you know, for example, dry it out and you make a powder out of it without adding anything. I would like 1000% take it." (Transcript 2, P10, 00:32:21)

Participants emphasized the need to avoid negative terminology such as "leftovers" or "waste" to prevent adverse perceptions, which is shown in this dialogue between two participants:

P10: *"I mean, as long as it's just sesame, whether it's just, you know, the leftovers, or, like, real sesame, it doesn't matter, At the end it is just sesame, people wouldn't really care if it's just left-overs you just write sesame and then they will take it." (...)*

P8: *"I think for Tunisians, we should not say it's left-over, because [...]"*

P10: *"Yeah, that's right."*

P8: *"Just not say it's leftover, or it's just from waste, or, I don't know, or from trash or something." (Transcript 2, P10 and P8, 00:43:17)*

Cultural aversion to waste was another important theme, reflecting a broader cultural tendency to make full use of food products and avoid waste. Participants mentioned that it is already a frequent practice in Tunisia to use the leftover parts of dates to make something for human consumption, thereby valorising the whole fruit. One participant highlighted,

"For example, date also like the seeds, we can use it, reuse it and grind for having coffee powder. There are products also in the Tunisian markets. And I already tried it, the powder coffee powder from the seeds of dates. And it's really an alternative to valorise the waste of this product and there are a lot of users to encourage the protein alternatives." (Transcript 2, P11, 00:48:53)

Psychological barriers

Participants identified strong psychological barriers to accepting certain alternative proteins in the conversations. Despite being aware of sustainability benefits, participants expressed strong negative reactions to consuming insects.

Cultural and emotional reactions were also highlighted as significant barriers. Even if certain alternative proteins are not explicitly forbidden by religion, emotional and psychological reactions play a central role. Participants explained that unfamiliar foods are often viewed negatively until proven otherwise.

"Actually, it's a very new thing. So it's not common at all. We don't have any data about it. So I think for Tunisian citizens, it's kind of very hard to perceive the health benefits about it. And we also tend to have a negative opinion about something we don't know. This is very Tunisian. Something that we don't know already is bad, until it's not." (Transcript 2, P8, 00:59:19)

These insights suggest that psychological barriers, including aversions to certain products, emotional reactions, and unfamiliarity, significantly influence the acceptance of alternative proteins among Tunisian consumers. Such barriers concerning alternative proteins derived from agricultural by-products were not mentioned.

Price Sensitivity

Participants frequently emphasized that the cost of their food choices plays a significant role in their decision-making process, especially for new products like alternative protein products. They noted that these "new" or "modern" products often come with a higher price, making them less accessible to a broader population. The ongoing economic situation, including inflation, was cited as a significant factor affecting purchasing decisions. Participants expressed concerns about their budget constraints and how it influences their ability to buy more expensive alternative protein products. As two participants explained respectively,

"The price, because most of alternative protein products, I think, come within a trend of alternative, eating habits and they're sometimes costly and not accessible, necessarily for everyone." (Transcript 1, P3, 00:25:04).

"I would say in Tunisia, as the others already said, they all did, the price is really important, because we have an inflation right now and people, compared to what we used to buy before, people do not have the budget for it right now." (Transcript 2, P12, 00:55:48)

Another recurring theme was the parallel consideration of cost alongside taste and quality. Participants indicated that while they might be willing to pay more for alternative proteins, the product must also meet their taste and overall quality expectations. Price perceptions varied between locally produced and imported products. Locally produced alternatives were seen as potentially more affordable and accessible than imported ones, which they thought would come with higher costs due to additional expenses like transportation and tariffs. Overall, participants highlighted that affordability is a critical factor that could hinder or facilitate the acceptance of alternative proteins.

Comparison to traditional protein sources

Participants frequently discussed the cost of alternative proteins compared to traditional protein sources, particularly meat, which are staples in the Tunisian diet. The rising prices of these traditional proteins have made them less accessible, prompting discussions on the potential role of alternative proteins as a viable substitute. Participants noted that people tend to eat less meat now because it has become so expensive.

There was consensus that alternative proteins could offer a more affordable option than traditional meat products. This potential cost-saving was a significant factor that could drive the acceptance of alternative proteins. Participants suggested that marketing strategies could leverage the high cost of meat to promote alternative proteins as a cost-effective and necessary source of nutrition.

Integration possibilities and market introduction

Integration and Product Attributes

As can be concluded from the existing literature and results, integrating alternative proteins into the daily diet poses a particular challenge, given Tunisia's strong culinary traditions and deeply rooted eating habits. In the group discussion, the question of how new products, such as alternative protein products, can be integrated into existing eating habits was addressed.

Participants emphasized the importance of blending new products with existing eating habits. One participant noted the difficulty of incorporating alternative proteins into traditional Tunisian dishes, stressing the need to find ways to integrate these products without disrupting established food routines or recipes. Participants suggested that for alternative proteins to be accepted, they should be easy to incorporate into familiar foods.

"If I think in a Tunisian way, I would say that people would not want to include it to any food or to any recipe that already exists, but maybe have it as something else, like maybe a snack or something to have with a coffee or with a tea or something, but I think, no chance to say, okay, you could add this to your Couscous, or you can add this to your Tajine or whatever. I don't think it would be accepted at all. I mean, we all know our grandmas or our mothers know it has to be this way and there is no other way."
(Transcript 2, P9, 01:02:50)

Several participants expressed that replacing traditional protein sources like meat with alternative protein products in main dishes would not be accepted. Some participants wondered whether the alternative protein products could be easily included in traditional meals, enhancing taste, texture, or protein content. Several others suggested incorporating these new products as snacks, breakfast items, or supplementary foods rather than primary meal components. Some examples were biscuits, chocolates, or new yoghurt flavours, which they could see as more readily accepted.

Participants also mentioned protein shakes or bars that could be integrated into the diet as convenient, healthy options for pre- or post-exercise consumption, specifically mentioning the success of new yoghurt flavours in Tunisia, suggesting that alternative proteins could be similarly accepted if integrated into familiar products. This idea was reflected in multiple comments from the focus group, explaining:

"[...] in the last years, we saw lots of new products, like in yogurt, it's very common in Tunisia that every month, we have new yogurt tastes and they [the people in Tunisia] just try." (Transcript 2, P8, 01:07:44)

"So I think the play with the yogurt, I like the idea of the yogurt, I think it's something that works all the time in Tunisia. It's crazy." (Transcript 2, P9, 01:11:15)

Nutritional content and benefits

Participants extensively discussed alternative proteins' nutritional content and benefits, highlighting the importance of these products meeting their nutritional needs. A significant concern was whether alternative proteins derived from sesame or date by-products could provide a complete amino acid profile like that found in traditional proteins like meat. They declared the need for alternative proteins to be nutritionally comprehensive to be considered viable replacements for traditional proteins. There were also doubts about the satiety and satisfaction provided by plant-based proteins. Participants said these products might not be as filling or satisfying as traditional protein sources.

Taste and texture preferences

The role of taste and texture in accepting alternative proteins was consistently highlighted.. Participants expressed that even if a product is healthy and packed with protein, it must also have an appealing texture to be considered. The challenge of integrating alternative proteins into traditional Tunisian meals was frequently mentioned, with participants indicating that the taste and texture must align with their expectations for traditional dishes. Participants noted that alternative proteins could be more successful if they offered an added flavour, such as sweetness or an enhanced texture. Products that provide an additional sweetening or flavour-enhancing component were viewed more favourably.

Market availability and trends

Accessibility in local vs. foreign markets

A topic frequently arising during both workshops was the accessibility of (alternative) protein products, emphasizing the significant differences between local and foreign markets. The participants highlighted the scarcity of these products in Tunisia, noting that it is challenging to find alternative protein sources beyond traditional meat and chicken or the cereals already used. The lack of awareness of these products in Tunisia was also discussed.

But the main difference is that in Tunisia, for example, you can't really find these protein shakes, you can't really find these products like tofu, for example. If you ask someone if he knows about tofu, I don't think everyone will find it in the supermarket. I mean, it's not that common at all to find protein-based products other than meat, or chicken, etc." (Transcript 2, P10, 00:17:15)

As mentioned before, participants noted a preference for locally produced items over imported products, suggesting that local production could influence the future acceptance of alternative proteins, especially due to concerns about financial accessibility and sustainability. Imported (alternative protein) products were seen as less accessible and potentially more expensive, adding another layer of complexity to their adoption.

Perceived market trends

Regarding the potential market introduction, they mentioned current economic challenges and rising prices for traditional protein sources as factors that could promote the future acceptance of alternative proteins in Tunisia. Participants pointed out the economic challenges and explained,

I think it will maybe come in the next years, because now we have another challenge regarding meat and fish, the prices are getting higher, not all Tunisians can afford to eat meat, even though it is a very essential element in our food habits and traditions, but again, today, not all Tunisians can afford to buy animal products that are fresh and they are the basic sources of proteins." (Transcript 1, P4, 00:28:09)

Participants felt that the current market in Tunisia shows a significant lag in adopting dietary trends, like vegetarian or vegan diets, compared to countries like Germany. Despite this, participants expressed optimism about future trends, particularly among the youth in Tunisia, who are becoming more health-conscious and paying more attention to their dietary choices.

Marketing and Information

Marketing

The role of marketing is critical in introducing and popularizing alternative proteins. The focus group discussed various aspects of marketing, from traditional advertising to the use of social media influencers, emphasizing the importance of tailored marketing approaches. Key themes from the discussions include lifestyle changes driven by marketing, the power of social media, trust in local brands and individuals and the emphasis on health benefits in marketing messages.

Participants noted that marketing has successfully introduced and normalized products previously unfamiliar to Tunisians. One participant gave the example of oats, which were not commonly consumed in Tunisia a decade ago but have become popular due to health-focused marketing campaigns.

Several participants emphasized the potential role of social media influencers in promoting alternative proteins. They suggested that influencers could significantly impact public perceptions and acceptance of these products. One participant noted

"For example, you can find a lot of small businesses in Tunisia, like women trying to cook. If they're good at making something, they would make it and put their names on it, like label the brand, literally by their names. And if you trust that woman, she's, you know, she has good hygiene and she's clean etc., then you would buy a lot from her. And she would also sell her products to the supermarkets, like local supermarkets there. And people would buy because they know the women, they trust her. So for example, if you label the dates by someone you know there and if you collaborate with someone, for example, who's famous and whom everyone loves in Tunisia, they would definitely buy the products because they trust that person." (Transcript 2, P10, 00:36:21)

Participants mentioned that Tunisians tend to trust products made by known local producers or endorsed by people they know. They explained that collaborating with well-known and trusted individuals could enhance the acceptance of alternative proteins. One participant shared,

"I agree with [Participant 11] and I think, if the marketing is also done with some kind of including scientists and not any industries behind it, it's very appreciated in Tunisia, because everyone is afraid of people that want to make money with these products." (Transcript 2, P9, 01:02:50)

Participants suggested that marketing messages should focus on the health advantages of alternative proteins, such as their potential to prevent cardiovascular problems or improve overall health. The discussion also highlighted the importance of not framing alternative proteins as 'leftovers' or waste products. Participants stressed that the terminology used in marketing should be carefully considered to avoid negative connotations.

Overall, participants agreed that well-planned marketing strategies incorporating local trust, social media influence, and a focus on health benefits could significantly enhance the acceptance of alternative proteins in Tunisia.

Information sources

Finally, the Participants underscored the importance of reliable and transparent information sources for accepting alternative proteins. They stressed the importance of scientific validation and credible sources, preferring detailed product information, including products' origins, manufacturing processes, and health benefits. Social media and trusted local sources were named effective channels for disseminating this information. Additionally, participants emphasized the need for broader awareness and education about alternative proteins. This desire for information extends beyond marketing, highlighting the need for credible and trustworthy sources.



3.3.3 Conclusions regarding consumers' interest in same cake and date by-products in Tunisia

This study investigated Tunisian consumer's acceptance of alternatives derived from sesame and date by-products, including their awareness, cultural influences, and willingness to adopt these novel sources. While a small sample size in focus group discussions limits generalizability, this qualitative approach provided deep insights into socio-cultural factors influencing food choices. The findings provided valuable context for understanding perceptions and developing focused solutions for future protein supply, food security, health, and sustainability.

Cultural and culinary traditions significantly shape food preferences in Tunisia. Familiarity with traditional ingredients like dates and sesame fosters openness to alternative proteins. Any new food product, including alternative proteins, must align closely with established preferences and food culture to gain acceptance. Marketing these proteins as familiar products rather than entirely new categories could enhance their integration.

The findings revealed varying levels of awareness regarding general protein consumption and alternative proteins among participants. Despite not feeling the need for alternative protein sources, many recognize potential health benefits, yet few are aware of their environmental impacts. This highlights a critical knowledge gap, underscoring the need for targeted education to enhance consumer understanding of the broader benefits of alternative protein consumption.

Key factors influencing Tunisian consumers' willingness to integrate alternative proteins derived from agricultural by-products include health benefits, the perceived naturalness and minimal processing of foods, and price sensitivity. The economic context in Tunisia, characterized by high inflation and reduced household incomes, makes the price a critical factor. A strong preference for minimally processed foods aligns with the Mediterranean dietary culture. Emphasizing health benefits and leveraging social influence and trusted local figures could be central to enhancing acceptance. By addressing these factors through culturally sensitive product development, targeted education, consideration of the economic situation, and strategic market placement and marketing, the integration of alternative proteins derived from sesame and date by-products into Tunisian diets can be significantly enhanced.

3.4 Consumers' interest in mycoproteins in Portugal

3.4.1 Study design, data collection and data analysis

To investigate Portuguese consumers' interest in mycoproteins two focus groups workshops were conducted in person at Universidade Católica Portuguesa (UCP) Porto, Portugal in June 2024. 22 Portuguese participants were recruited using the non-probability convenience sampling method to get a diverse range of age groups or genders. The first session had 10 participants, while the second session had 12 participants.

The discussions, moderated by the researcher from UCP were in Portuguese language, and followed the general interview guideline adapted to the focus product mycoproteins. All attendees gave their written informed consent prior to the discussions and were rewarded with a 10 Euro gift voucher for participating. In addition, something to eat and drink was provided. Figure 1 shows some impressions from the room where the discussions took place.

All attendees participated strongly in the discussion. The atmosphere was open and conducive to discussion. Both workshops were recorded and additionally, handwritten notes were taken. Subsequently, work began on transcribing and translating these recordings.

The results described in section 3.4.2 are based on a summarizing analysis of the notes taken during the workshops.



Figure 1: Impressions from the focus group discussions (photo: Mergel)

3.4.2 Consumers' general interest in mycoproteins in Portugal

In total, 17 women and 5 men took part in the workshops; the majority (n=13) were younger and nine were older than 40 years. All participants were omnivores, and most lived in 2- or 3 person households. The vast majority indicated to shop their food in supermarkets.

Table 5. Description of the sample (mycoproteins, Portugal)

		n	%
Gender	male	17	23
	female	5	77
Age Group	18-25 years	2	9
	>25-40 years	11	50
	>40 years and older	9	41

General Interest and Awareness

Firstly, initial thoughts and impressions about alternative protein food products were collected. Overall, various respondents expressed a willingness to try foods with alternative proteins, emphasizing the importance of keeping an open mind towards innovation. Other individuals, who were also willing to try, expressed simultaneously some suspicions or identified risks. In contrast, various individuals do not see themselves consuming alternative proteins because they are unfamiliar to them, perceive them as distant or irrelevant, do not recognize them as part of their culture or tradition, or do not have enough information about these products. A significant issue identified in this context is the dilemma between trying new foods and distrusting them, mainly due to insufficient information. Attendees also remarked that there is an absence of informational campaigns that could draw attention to and educate people about these new products. Other participants had reservations due to health or dietary reasons, as they had, for example, concerns about the nutritional value, also compared to traditional protein sources like meat, and potential risks such as food allergens. In addition, one participant preferred a balanced diet comprising a variety of healthy foods rather than relying solely on alternative proteins.

Besides the reservations, the sustainability aspects of alternative food products were also discussed. While there is a tension between the appeal of sustainability and the resistance to adopt new food sources due to various reasons for one attendee, the concept of sustainability and the circular economy associated with alternative protein products is appealing to various others. For example, one respondent evaluated the sustainability of alternative foods as being higher than of traditional foods. In addition, it was mentioned that sustainability efforts and related ‘propaganda’ could drive the adoption of alternative protein sources. Alternative proteins were seen to address global warming concerns. In addition, the necessity of seeking alternatives that do not deplete the planet’s resources was expressed. Here the discussion also touched on the challenges posed by a growing global population and the resulting strain on resources. In this line, it was also raised that more industrial options are needed, rather than relying solely on natural protein sources.

Participants mentioned also several groups or individuals who could benefit from the consumption of alternative proteins. For example, they acknowledged the benefits of alternative proteins for individuals who engage in sports or gym activities, as well as for vegetarians or vegans who need to compensate for the lack of animal protein or for individuals with food intolerances. Also substituting animal protein with alternative sources was considered beneficial for other groups with specific dietary needs, such as those with cancer or those who struggle to absorb or ingest traditional protein sources. Lastly, one participant noted that linking alternative protein sources with insects potentially leads to disgust among consumers.

After collecting the initial thoughts and impressions on alternative food products, participants shared varied experiences or instances where they came across alternative protein food products. While one participant reported usually not consuming these products, others described experiences with various products. For example, one attendee once tried tofu, a soy product, and has incorporated it now into the regular diet. Interestingly, however, there was a divide among focus group participants, with some considering soy products (tofu/seitan) as alternative proteins and others viewing them as regular proteins. In the case of soy products, a disappointing experience was also shared by a participant who bought soy burgers to prepare at home. Despite using spices and condiments, the burgers were found to be insipid and did not meet expectations, leading to a decision not to repurchase.

Another attendee tasted meatballs made with insects and cooked in tomato sauce, which were found interesting but culturally unfamiliar. In addition, one recently tasted alternative protein beverages, leading to mixed reactions—one beverage was likened to a cappuccino and enjoyed, while others were found astringent. Further reported experiences were the use of alternative proteins for sports nutrition, or as an option for healthy alternative snacks, as well as e.g. in new meal options with increased protein intake from non-traditional sources such as legumes. Attendees also mentioned that they were aware of discussions on alternatives like lupin.

In addition, attendees reported several places and occasions where they encountered alternative protein products.

Even though they said that soy products like tofu and seitan are not standard in most people’s consumption habits, it was noted that they are widely available in supermarkets and restaurants. For example, vegetarian products mimicking traditional dishes, such as vegetarian versions of the Portuguese ‘francesinha’, are becoming more common in restaurants. In this respect, a general willingness to try alternative proteins at restaurants was also expressed. The same applies to dining at a friend’s house. In the case of supermarkets, participants also reported about promotional tastings which introduced them to alternative protein products. Another participant highlighted their workplace, which serves a pea-based burger that has become a favourite.

Moreover, the factors influencing interest or lack of interest in trying alternative protein food products were discussed. Positive factors leading to interest and adoption are summarized first: The discussions

showed that alternative protein products are gaining popularity for a multitude of reasons. One important reason mentioned is the perception of the products being sustainable, which resonates with a growing number of individuals who are concerned about sustainability. Further, ethical considerations also play a role, as concerns about animal rights and welfare drive individuals to seek out these alternatives. In addition, aspects of health and well-being were mentioned, as there is a growing interest in health. Due to this it is also helpful when nutritionists endorse these products. A further positive factor is that these products are also increasingly seen as fashionable and desirable, particularly among young adults who are influenced by social media and influencers. However, the influence of social networks plays a general role in generating interest and encouraging the adoption of alternative protein products. An additional positive factor is that incorporating alternative proteins into one's diet enhances dietary variety. A further beneficial factor is when the products are practical and convenient to use.

Several factors which hinder the further adoption of alternative protein products were also mentioned in the discussion. Price was discussed as a significant barrier to adoption, as these products were often regarded as expensive or more expensive than traditional protein sources. In addition, sensory attributes such as insipid taste, lack of flavour, and poor texture were also reported as factors negatively influencing interest in alternative protein products. Moreover, alternative proteins were partly perceived as less satiating than traditional proteins. Additionally, lack of experience with these products, limited availability, and a lack of options to replace most traditional protein sources play a role. Also, several disadvantages regarding the preparation were discussed. These included, for example, impracticability and missing convenience, as some natural alternative protein options require long preparation times, which is combined with high energy consumption. Another participant was concerned about heavy processing and the presence of many additives. Dissatisfaction with the products and trust were additional raised aspects. In this regard, the credibility of the provided information was discussed. Also, a distrust was found when alternative proteins were perceived as merely fashionable trends. Despite the growing interest in sustainability and healthier lifestyles, some attendees remain unmotivated by these benefits. Lastly, also social influences were mentioned: In this regard, it was brought up that these products may not be well-received by all friends. Further, one participant reported that it is impractical to prepare different meals for everyone, particularly in families with older members who resist change. Lastly, it was mentioned that food enthusiasts, particularly those who enjoy traditional foods, may find it challenging to switch to plant-based proteins.

Perceptions and Preferences

The factors that are important to the participants when trying new foods were also discussed. When trying new foods, the participants regarded several factors as crucial: Firstly, price was discussed as a critical factor in the decision to try new foods. Also, ingredients are important, as there was a preference among the participants for foods with fewer additives, less sugar, and less fat or for foods that are high in protein and energy. Connected to this, health aspects were also discussed, including the products' suitability for fitness. In this context, one attendee also expressed a willingness to try new foods if they are plant-based and another if they complement the diet by allowing for reduced consumption of meat and fish proteins. In addition, sensory attributes such as taste, texture, and overall sensory experience were noted as important for trying new foods. Here, a strong aversion to foods considered disgusting, such as insects, came up in the discussion. Others noted a preference for crunchy over soft textures, particularly with foods like fungus. Providing information on preparing and using new products was also considered essential. For example, the versatility of new foods in various dishes, such as salads and desserts, interested some attendees. Moreover, convenience of preparation was reported to be important for trying new food. For others also, the experience of trying something new served as motivator. Lastly, it was pointed out that ensuring the traceability of the food and information about its producer is important for trying new foods.

In a next step, participants were asked how they perceive the health benefits of alternative protein, especially Mycoprotein, compared to traditional protein sources. Overall, participants had difficulty evaluating alternative proteins' health benefits. For example, in the first session, a significant barrier was the lack of familiarity with mycoproteins among participants, making it difficult for them to form an opinion. Similarly, participants saw an evident information gap in the second session, as no specific details about the composition of mycoproteins were provided or available to the group. Despite this, the group also expressed, that they perceive mycoproteins to be as healthy or even healthier than traditional and insect proteins. Mycoproteins were also seen as innovative and were not expected to contain preservatives, colorants, added sugars, or saturated fats. Also, unlike insect proteins, Mycoproteins did not evoke a sense of disgust.

Next, the discussion turned to cultural or social influences, which might impact ones' acceptances of mycoproteins. Firstly, it was noted, that age plays a crucial role in this respect, with older individuals being less prone to accept new products than younger people. Also, social media platforms like TikTok, significantly influence acceptance, especially among younger demographics. In this respect attendees noted that influencers or famous personalities are vital in gaining acceptance among young people and teenagers. Additionally, proper nutritional education can positively impact the acceptance of mycoprotein by informing potential consumers about its benefits and uses.

Lastly, participants discussed to what extent they were concerned about the environmental impact of the food products they consume. In session 1, participants acknowledged the positive attribute of environmental impact in food choices, though it was not the primary driving factor. In contrast, participants in session 2 raised a more specific concern for environmental aspects, particularly related to packaging, recycling, and the presence of microplastics. Participants expressed a strong preference for sustainable practices, with an emphasis on fresh, small-scale, and local production.

Specific preferences and concerns related to mycoproteins:

In the next phase of the focus group workshops, attendees discussed their specific preferences and concerns related to mycoproteins. Firstly, participants were asked whether they were willing to try alternative protein food products derived from mycoproteins. Participants showed a general willingness to try mycoprotein-derived food products. In Session 1, all participants expressed this willingness outright. In the second session, the group was also open to trying these products if they had an appealing appearance, smell, and texture. However, several concerns were raised, too. One significant issue was the excessive promotion of protein by advertisements, influencers, and publicity, which participants found off-putting. There was also a notable lack of sufficient information about mycoprotein products, leading to uncertainty. Health concerns were also expressed, with participants doubting whether mycoprotein would benefit their health. Lastly, potential allergen problems in mycoprotein products were a cause for concern for the attendees.

Next, the qualities of food products derived from mycoproteins making participants more likely to purchase them were discussed. Regarding desirable qualities for mycoprotein, participants in both sessions highlighted several key attributes.

Participants emphasized that the price of the products is an important factor in the purchase decision and that mycoprotein proteins should not be more expensive than traditional proteins. Further, good sensory quality is crucial to making the product pleasurable and acceptable for individuals and their families. Health benefits is a further desirable quality, and it was noted that mycoprotein food products should be healthier than traditional protein sources. Further, convenience was raised as important. However, there were also different preferences here: While some participants wanted ready-to-eat options, others did not. Clear information on how to use mycoproteins was also discussed as essential. While it was noted that mycoprotein products should enable new experiences, familiarity was evaluated as a desirable quality by others. Lastly, positive endorsements from influencers were seen as beneficial for purchase.

Finally, this section ended with a discussing specific flavours, textures, or preparation methods that could enhance participants' enjoyment of food products derived from mycoproteins. Ensuring good sensory quality was discussed as essential, though it was also acknowledged that preferences can vary widely among individuals. In addition, attendees emphasized the importance of providing information on the use and on recipes to help incorporate mycoprotein food products into meals. Further, convenience was important, with participants favouring products that are easy and fast to prepare. Others demanded that the products' name should not lead to false expectations. Besides these more general aspects more specific preferences also came up. For example, preferences for a crunchy texture or chocolate-flavoured mycoprotein products were expressed.

Findings regarding market introduction and marketing strategies

In the last part of the workshops, aspects regarding market introduction and possible marketing strategies for alternative protein products were discussed. Participants mentioned general advertising, printed promotional materials such as leaflets and promotions as means of discovering new food products. Social media exposure through various platforms is another option to discover new food products on the market. Specifically, attendees mentioned TikTok videos and the recommendations and endorsement of influencers in the discussions. In addition, recommendations from friends, colleagues, and university news also play a role. The same applies to children, as their exposure to new products can influence household purchases. Attendees also mentioned that dining out provides an opportunity to encounter new products in restaurants. High protein products and supplements are often discovered in sports stores.

Asked what marketing strategies would effectively capture one's attention and interest in alternative protein food products, various aspects came up: Promotions with tasting opportunities in supermarkets were highlighted as a valuable strategy, allowing potential customers to sample the products. Also, general promotions, including discounts, special offers, and promotional events, were seen as effective in attracting attention. Participants also stated that social media platforms are essential for advertising. Leveraging social media influencers to endorse and promote the products was considered crucial. Expert endorsements from known nutritionists, medical doctors, and pharmacists were recommended to build credibility and trust. Creating educational programs to inform consumers about the benefits and uses of alternative proteins was suggested. Additionally, featuring the products in popular soap operas was proposed to increase visibility and acceptance.

Finally, participants identified several specific channels and platforms preferred for receiving information about food products. Social media platforms such as Instagram, Facebook, and TikTok were highlighted as top choices for updates and information. Traditional television was also considered an effective channel. Additionally, live cooking demonstrations and shows, in-person or broadcast, were seen as engaging and informative ways to learn about new food products.

3.4.3 Conclusions regarding consumers' interest in mycoproteins in Portugal

The analysis of the discussions showed that part of Portuguese consumers is willing to try alternative proteins, but others are also sceptical due to unfamiliarity with the products or cultural and traditional reasons. This result is in line with the mixed prior experiences with such products, as some had already contact with such products, for example, in supermarkets or restaurants or even tried them, and others did not report such experiences. Interest in alternative protein food products can, for example, be fostered when the products have advantages regarding sustainability, health or well-being aspects, and convenience, and are promoted as fashionable. However, importantly, the products must be affordable, have good sensory quality, and are widely available. Specifically, the discussion also proved a general willingness to try alternative protein food products derived from mycoproteins. Good sensory qualities are a prerequisite to reaching acceptance of mycoprotein products, too. Further, the unfamiliarity with mycoprotein products and the lack of information about mycoprotein products must be eliminated using classical advertising, consumer promotions or social media marketing, especially to reach younger target groups. Also, experts' recommendations are important in this regard. Further, people demanded usage information for the mycoprotein products, for example, in the form of recipe

ideas. Like in case of alternative protein food products in general, the pricing of mycoprotein products is significant for the final purchase decision. Thus, consumers' willingness-to-pay should be carefully surveyed before introducing such products to the market. Further, additional benefits like health or convenience are important for the success of the mycoprotein products and thus should be considered in the product development process as well as in the marketing of the final products.

4. Conclusions

This study analysed Mediterranean consumer's general interest in alternative protein food products. The study focused on Türkiye, Tunisia, and Portugal, as well as various alternative protein food products, including pickles infused with proteins from tomato pomace and leaves, insect proteins, sesame cake and date by-products, and mycoproteins. The study aimed to identify possible drivers and cultural and religious barriers and resistances to alternative protein food products, which can be addressed during the product development process and the market introduction of innovative alternative protein food products for the Mediterranean food markets.

The results of this study show that the general interest and awareness of alternative proteins varies between Mediterranean consumers and countries and also depends on the specific food products. While some consumers are open to trying such products in every country, others do not feel the need to consume alternative protein sources, are sceptical about such products due to different reasons, or even refuse them, especially in the case of insect-based products. Thus, these results emphasize the importance of determining the interest for the specific innovative alternative protein food products and in the respective target market before launching the products to avoid market failure.

Various factors influence the interest of Mediterranean consumers in new alternative protein food products. These factors include cultural aspects, such as familiarity, tradition, culinary habits, and religious guidelines. Thus, culturally sensitive product development is essential, especially in Mediterranean countries with their rich culinary history and strong dietary habits. In addition, factors related to the products are essential. Most notably are the sensory qualities of the product, but also affordable prices and availability in the markets. The results emphasize that good sensory qualities are a general prerequisite when developing new alternative protein food products, as consumers are not prepared to accept compromises. In addition, it is important that consumers can access these products in their familiar shopping places; that is, products must be widely available in supermarkets, discount stores, and most importantly, not only in urban areas but also in rural regions. Lastly, precise pricing strategies are of utmost importance. While this is true for every Mediterranean target market, it is essential in countries and markets with a difficult economic situation.

The results of this study also indicate that alternative protein sources derived from familiar or traditional agricultural products like dates, sesame (Tunisia) or tomatoes can enhance the openness to innovative alternative protein products. In addition, the integration of the alternative proteins into popular staple foods, like pickles in Türkiye, can be a promising strategy to introduce alternative proteins in rather traditional food markets. However, a precondition for the success is in such cases again, that the new products meet traditional expectations regarding sensory qualities, meet common food preferences (e.g. for minimal processing) and that they align with the established food culture. Moreover, the study showed that Mediterranean consumers value the sustainable use of by-products such as tomato pomace and that also potential health benefits of alternative protein sources are recognized. Summing up, marketing alternative proteins from agricultural by-products as part of familiar food products rather than entirely new categories as well as promoting them as sustainable and healthy alternatives could enhance their integration into Mediterranean diets.

The results for the more uncommon alternative protein sources mycoproteins and insect-proteins differed. In the case of products based on mycoproteins there was a general willingness to try such products observable but only if the products provide good sensory qualities. However, unfamiliarity with this protein source and lack of information about such products was also detected. Thus, educating consumers about mycoprotein product seems important for their market success. Besides, such products should offer additional benefits like health improvement or convenience, as these qualities are valued by Mediterranean consumers.

Insect-based products evoke a range of consumers' reactions from openness to disgust, as shown by the results of this study. What is unique with insect-based products is that the appearance and presentation of the food products seem to have an essential impact on Mediterranean consumers' acceptance. Forms that do not remind the original insect form, such as powder or capsules, are more accepted. This should be considered when developing alternative insect-based products. Besides, concerns about hygienic aspects or potential health effects arose, while insect-based products were also evaluated as more environmentally friendly. Thus, good hygienic conditions of the production process are essential for such products. In addition, the product's potential health and sustainability impacts should be communicated to the consumer. Especially for Mediterranean consumers who follow specific religious food guidelines, it is important to clarify with the religious authorities whether the innovative insect-based products fulfil the relevant requirements. If yes, this should be labelled on the product. If not, the innovative alternative food product is unacceptable for people following strict religious food guidelines.

The results of this study also identified several important factors for developing marketing strategies for alternative protein food products. First, a carefully designed pricing strategy is essential. Importantly, the strategy must consider the specific economic situation of the target market. To promote innovative alternative protein food products, a mix of classical advertising campaigns, consumer promotions, and social media marketing seems necessary, as all these channels have been identified as important for discovering new food products in the Mediterranean markets. To reach younger consumers, especially social media and influencer marketing, is significant. However, the communication activities should be culturally sensitive and trustworthy, considering the specific characteristics of the respective Mediterranean food market.

This study identified various starting points to increase the interest in alternative protein food products in Mediterranean countries and thus enhance the success of integrating alternative proteins into Mediterranean diets. This is desirable because promoting the introduction of alternative proteins can significantly reduce dependence on animal-based proteins, contribute to environmental sustainability, reduce the use of resources such as water or energy, and improve food security. Encouraging global populations to adopt healthy plant-based diets is vital for reducing chronic diseases and addressing the broader challenges of environmental sustainability and global food security. Transformative public health policies and interventions are crucial to fostering this dietary shift, which has the potential to reshape food systems worldwide. Alternative proteins derived from local agricultural by-products offer a powerful solution, capable of enhancing personal health and strengthening food security while minimizing environmental impact. Investing in optimizing nutritional content, refining production methods, and cultivating public acceptance can pave the way for these innovations to become integral to our food systems. Embracing this comprehensive approach is essential for creating a healthier, more resilient, and sustainable future for all.

5. References

- ATAY, N. 2024. *Consumers' Acceptance of Insects as an Alternative Protein Source in Turkey*. Master's Thesis, TU Munich.
- BALTACI, B. 2024. *Consumers' acceptance of pickles infused with protein derived from tomato pomace and leaves: A focus group study in Türkiye*. Master's Thesis, TU Munich.
- DRESING, T. & PEHL, T. 2015. *Praxisbuch Interview, Transkription & Analyse: Anleitungen und Regelsysteme für qualitativ Forschende*, dr. dresing & pehl GmbH.
- KUCKARTZ, U. 2012. *Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung*, Juventa, Beltz.
- KUCKARTZ, U. 2014. *Qualitative Text Analysis: A Guide to Methods, Practice & Using Software*. London: SAGE Publications Ltd.
- KUCKARTZ, U. 2019. *Qualitative Text Analysis: A Systematic Approach*. In: KAISER, G. & PRESMEG, N. (eds.) *Compendium for Early Career Researchers in Mathematics Education*. Cham: Springer International Publishing.
- MACK, B. & TAMPE-MAI, K. 2012. Konzeption, Diskussionsleitfaden und Stimuli einer Fokusgruppe am Beispiel eines BMU-Projekts zur Entwicklung von Smart Meter Interfaces und begleitenden einführenden Maßnahmen zur optimalen Förderung des Stromsparens im Haushalt. In: SCHULZ, M., MACK, B. & RENN, O. (eds.) *Fokusgruppen in der empirischen Sozialwissenschaft: Von der Konzeption bis zur Auswertung*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- MOSER, A. & AND KORSTJENS, I. 2018. Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European Journal of General Practice*, 24, 9-18.
- O'BRIEN, B. C., HARRIS, I. B., BECKMAN, T. J., REED, D. A. & COOK, D. A. 2014. Standards for Reporting Qualitative Research: A Synthesis of Recommendations. *Academic Medicine*, 89.
- PATTON, M. Q. 2005. Qualitative Research. *Encyclopedia of Statistics in Behavioral Science*.
- RABIEE, F. 2004. Focus-group interview and data analysis. *Proceedings of the Nutrition Society*, 63, 655-660.
- RÄDIKER, S. & KUCKARTZ, U. 2019. *Analyse qualitativer Daten mit MAXQDA*, Wiesbaden, Springer VS Wiesbaden.
- SCHULZ, M. 2012. Quick and easy!? Fokusgruppen in der angewandten Sozialwissenschaft. In: SCHULZ, M., MACK, B. & RENN, O. (eds.) *Fokusgruppen in der empirischen Sozialwissenschaft: Von der Konzeption bis zur Auswertung*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- TAUBER, A. A. 2024. *Consumer acceptance of protein-enriched modified foods: A case study looking at sesame cake and date by-products as an alternative protein source in Tunisia*. Master's thesis, TU Munich.
- TONG, A., SAINSBURY, P. & CRAIG, J. 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, 19, 349-357.

6. Appendix

A: General Workshop Guideline

Topic: Exploring Consumer Acceptance of Alternative Proteins

Objective:

The workshop aims to delve into the complex landscape of consumer attitudes and perceptions regarding alternative proteins. It seeks to understand the factors influencing consumer willingness to integrate these proteins into their diets and to explore strategies for fostering sustainable food systems.

Key Objectives:

Report on consumers' current knowledge about alternative proteins

Explore consumers' general interest in alternative protein food products

Analyse consumer preferences and willingness to pay for developed alternative protein food products

Identify strategies for marketing and market introduction of alternative protein food products

Methodology:

The workshop will employ a qualitative approach, utilizing focus group discussions involving 6-10 participants. This method is chosen for its suitability in exploring context, culture, and social norms, allowing for an in-depth exploration of consumers' attitudes towards alternative protein products derived from by-products.

Recording and transcription of workshops for qualitative content analysis.

Workshop Materials:

Workshop schedule and interview guideline incorporating open-ended questions

Consent forms for participants regarding recording and transcription of discussions

Tools for qualitative content analysis

Workshop Outline:

I. Introduction

- Overview of the research objectives and the significance of exploring alternative protein sources
- Obtaining consent for participation
- Explanation of the focus on Alternative Proteins

(1) Understanding Consumer Attitudes and Acceptance

- Discussion on factors influencing consumer acceptance of alternative proteins:
- Cultural Influences / Social norms
- Health Perceptions
- Environmental Considerations
- Demographic Factors

(2) Exploring the Cultural Food Landscape

- Analysis of current food consumption trends and market dynamics in the analysed country

II. Outro, Thank you and Goodbye

Next Steps after the Workshops:

Reporting and Analysis

- Summarization of key findings from focus group discussions
- Identification of common themes, concerns, and preferences among participants
- Comparison with findings from the literature and previous research

Conclusion and Next Steps

- Discussion on implications for sustainable food systems and economic development
- Outline of next steps, including further research or initiatives based on workshop outcomes

Workshop Guideline: Open-Ended Questions

Introduction (5min):

Welcome - and first of all thank you for joining us today for this workshop. Your insights and perspectives are incredibly valuable as we explore the landscape of alternative protein food products. Our goal is to engage in an open and constructive discussion to understand your thoughts, preferences, and potential acceptance of these innovative food products.

Throughout this session, we'll be discussing various aspects of alternative protein food products. We're interested in hearing your experiences, perceptions, and concerns to gain a deeper understanding of how these products might fit into diets and lifestyles.

Before we begin, we want to assure you that your privacy and confidentiality are of utmost importance to us. The session will be audio recorded to not lose any information given by you during the workshop. All information shared during this workshop will be treated with strict confidentiality. Your responses will be anonymized and aggregated for analysis purposes only. The data collected will be used solely for academic research purposes.

Your participation in this workshop signifies your consent to the recording and analysis of the discussion. If you have any concerns about data security or the use of the results, please feel free to raise them at any time during the session. We are now handing out the consent forms for your participation. Please take a moment to review these documents thoroughly. They contain important information about the workshop procedures, your rights as a participant, and how we will handle the data collected during this session. After reviewing, please sign the forms to indicate your agreement and understanding. Your participation is entirely voluntary, and you are free to withdraw at any time without any adverse effects. If you have any questions or need further clarification on any aspect of the documents or the workshop itself, do not hesitate to ask.

This workshop will take approximately 60 minutes. During this time, we'll be covering a range of topics related to alternative protein food products. Specifically, we'll be discussing:

1. General interest and awareness
2. Perceptions and preference
3. Specific preferences and concerns related to alternative protein food products
4. Additional insights

This is an opportunity for you to share your honest opinions and insights, so please feel free to express yourself openly. There are no right or wrong answers, and every perspective is valuable in shaping our understanding of consumer attitudes towards alternative proteins.

Participant introduction (5min)

Let's start with a small introduction round. Please introduce yourself with your name, where you're from (countryside / small / big city), what you study and what your go-to-food for a chill evening is! Let's keep it short and sweet to get the conversation flowing!

Introduction to Alternative proteins:

In today's discussion, we'll be exploring the concept of alternative proteins and their potential role in shaping the future of food. Alternative proteins refer to unconventional protein sources that extend beyond traditional animal and plant-based sources. These include novel sources like mycoproteins, microalgal-based products, and by-products derived from various agricultural processes.

Introduction to specific product (5min)

First of all: You do not need specific knowledge to participate in the discussion, we just want to give you a broad understanding of the topic.

In today's discussion, we'll be exploring the concept of alternative proteins and their potential role in shaping the future of food. Alternative proteins refer to unconventional protein sources that extend beyond traditional animal and plant-based sources. These include novel sources like mycoproteins, microalgal-based products, and by-products derived from various agricultural processes.

One example of alternative protein sources that we'll be focusing on today is [PRODUCT].

[PRODUCT=

insect protein (TR) /

sesame by-products (TU/GER) /

Mycoproteins (PT/GER)].

[Product information, specific for the PRDODUCT e.g.]

Sesame by-products are agricultural by-products, which possess significant nutritional value, including protein, fiber, and essential minerals. At the moment they are often underutilized and may be commonly used as animal feed or discarded as waste. But there's growing interest in repurposing them for human consumption as alternative protein sources. This could be in the form of protein powder or traditional foods like for example tahini enhanced with these by-products to increase the protein-content.

That's it, for a short introduction. Again: you do not need specific knowledge to participate in the discussion, this is just for context and general understanding of the topic.

Do you have any questions?

...

Then let's start with the questions

Questions:

1. General Interest and Awareness (10min)

- (1) What are your initial thoughts or impressions when you hear about alternative protein food products in general?
- (2) Can you share any experiences or instances where you've come across alternative protein food products?
- (3) Awareness of any alternative protein sources currently available in the market
- (4) How do you think alternative protein food products could fit into your current diet or lifestyle?

Factors influencing the interest or lack of interest in trying alternative protein food products

2. Perceptions and Preferences (15min)

- (1) When you think about trying new foods, what factors are most important to you?
- (2) How do you perceive the health benefits of alternative protein food products compared to traditional protein sources?
- (3) Which cultural or social influences might impact your acceptance of alternative protein food products?

To what extent are you concerned about the environmental impact of the food products you consume?

3. Specific Preferences and Concerns related to alternative protein food products (30min)

- (1) Would you be willing to try alternative protein food products derived from [PRODUCT]? Why or why not?
- (2) What qualities would make you more likely to purchase [PRODUCT]?
- (3) Concerns or reservations about consuming alternative protein food products
- (4) Are there any specific flavors, textures, or preparation methods that you think would enhance your enjoyment of this [PRODUCT]?

4. [Back-up Questions] Market Introduction and Marketing Strategies:

- (1) How do you usually discover new food products in the market?
- (2) What marketing strategies would effectively capture your attention and interest in alternative protein food products?
- (3) Are there any specific channels or platforms where you prefer to receive information about food products?
How do you typically discover or learn about new food products in the market?
- (4) What do you think would be the most effective way to introduce alternative protein food products to consumers like yourself?

5. Additional Insights (5min)

Is there anything else you'd like to share or discuss regarding alternative protein food products and their potential acceptance?

Conclusion:

Thank you all for your active participation and valuable contributions to today's workshop. Your insights have provided us with a deeper understanding of consumer attitudes and preferences regarding alternative protein food products.

The insights gathered from today's discussion will be carefully analysed and integrated into our research



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findings. We greatly appreciate your time and willingness to engage in this discussion, as your input will play a crucial role in shaping the direction of our research and potential strategies for sustainable food systems.

If you have any further thoughts or reflections after the workshop, please don't hesitate to reach out.

Thank you once again and have a great day/ evening/ week!

B: Questionnaire Group Discussion

Questionnaire Group Discussion

The following questions relate to your person and your grocery shopping habits.

5) Please note your gender

- ☐ Male
- ☐ Female
- ☐ Diverse

5) How old are you?

- ☐ 18 – 25 years
- ☐ 26 – 40 years
- ☐ Over 40 years

5) Which diet applies to you the most? Multiple answers are possible.

- ☐ Omnivorous diet (animal and plant products)
- ☐ Vegetarian diet
- ☐ Vegan diet
- ☐ Sustainability in food is important to me
e.g. organic labels, fair trade, animal welfare or regionality
- ☐ Other _____

5) How many people live in your household, yourself included?

5) What is your preferred shopping place for food?

- ☐ Farmer's market
- ☐ Discount Store
- ☐ Supermarket
- ☐ Others: _____

Use of AI Disclaimer:

This document was created with the support of artificial intelligence.

<https://www.grammarly.com/> spell checking

<https://chatgpt.com/> rephrasing, spell checking

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