

The Future Role of Edible Insects: A Study on Perception and Acceptance among Chefs in Mersin Province

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Abstract

The aim of this study is to determine the approaches regarding the incorporation of edible insects into Turkish cuisine in the event of a potential food crisis. In this context, data were collected using a semi-structured survey technique. The participants of the study consist of 15 professional chefs operating in the province of Mersin. The obtained data were analyzed through content analysis using MAXQDA software. The researchers tabulated and explained the coding of participants' responses and the frequency analyses of the words used. According to the research results, it was determined that the prevailing opinion among the chefs is that edible insects would currently be negatively received by customers. However, in a scarcity situation, they could be integrated into Turkish cuisine through blending and fusion cooking techniques.

Keywords: Gastronomy, Edible Insects, Restaurants, Food Sustainability

1. Introduction

Factors such as rapid global population growth, limited natural resources, climate change and water scarcity pose significant challenges to food production and consumption (Godfray et al., 2010). These factors have serious implications for the environmental sustainability of conventional food production. Increased water consumption, soil erosion, biodiversity loss and greenhouse gas emissions are factors that intensify the environmental impacts particularly associated with traditional food production (Foley et al., 2011). Furthermore, the production of animal protein sources such as beef and chicken is an energy-intensive process that increases the demand for natural resources (Gerbens-Leenes et al., 2012). These issues raise serious concerns about future food security and environmental sustainability. In this context, alternative solutions are being sought for more sustainable and efficient future food systems. Among these solutions, the utilization of edible insects as a food source has become a notable area of research and application in recent years. Insects have traditionally been consumed in many cultures and recognized as a rich source of protein, fat, vitamins and minerals (Mlcek et al., 2014). Scientific studies support

the view that edible insects are a nutritious source (Bukkens et al., 2013; Rumpold and Schlüter, 2013).

The United Nations' 2030 Sustainable Development Goals emphasize the importance of incorporating insects into sustainable circular agriculture and highlight their role in food security, combating climate change and reducing biodiversity losses (Transforming Our World, 2023). These goals highlight the potential role that insects can play in human nutrition and ecosystems. The idea that edible insects are often considered an alternative food or used only in limited areas has been questioned (Lesnik, 2017). Recent evidence suggests that insects were an important food source in Tanzania 1.8 million years ago (Heriot-Watt University, 2018). Monkeys digested chitin in insect exoskeletons using an enzyme called acidic mammalian chitinase, which has long been recognized as a difficult substance to digest (Janiak et al., 2018). Overall, there is a general gradient pattern in which edible insects are declining, especially in areas where they are least abundant (Lesnik, 2017), possibly because insects are more common and easier to collect in tropical regions (Van Huis, 2018).

The Food and Agriculture Organization of the United Nations (FAO) and the European Food Safety Agency

(EFSA) have stated that edible insects can contribute to global food and nutrition security and effectively meet basic dietary requirements (Van Huis et al., 2013). So far, more than 2000 insect species that can be consumed in 113 countries have been documented. Examples of commonly consumed insects include silkworms, caterpillars, mealworms, grasshoppers, locusts, bees, ants and termites, showing the diversity of this alternative protein source (Pittaway and Kitching, 2000). In this context, the aim of this study is to measure the thoughts of restaurant chefs operating in Mersin province about the future role of edible insects and to answer the question: Are businesses in Mersin ready for this situation?

2. Conceptual framework Flow theory

2.1. The Future Role of Edible Insects

The potential critical role of edible insects in future food systems is noteworthy due to the advantages they can offer in terms of environmental sustainability, nutritional value and food safety (Van Huis, 2013). The rapid increase in global population, limited food resources and environmental sustainability concerns emphasize the growing importance of edible insects in this context. Their high reproductive rate and potential for rapid reproduction make insects particularly attractive as a sustainable protein source. Therefore, the role of edible insects in future food systems should be assessed to enhance sustainability in food production and consumption. However, cultural and educational barriers to insect consumption should also be taken into account and attempts should be made to overcome these barriers. In this context, the contribution of edible insects to mitigate future food security challenges is important and requires further research and application. Edible insects are increasingly attracting attention as a potential alternative to replace traditional protein sources (Meyer and Hull, 2017).

2.2. Studies Conducted

Van Huis (2020), in his study on insects as food and feed in the agricultural sector, concluded that insects have the largest store of antimicrobial peptides of all animals, and emphasized the need for further research into their nutritional and health benefits for animals and humans.

Guiné et al (2022) aimed to determine the level of knowledge on edible insects in thirteen countries (Croatia, Greece, Latvia, Lebanon, Lithuania, Mexico, Poland, Portugal, Romania, Serbia, Slovenia, Spain and Turkey). According to the findings of the research, it was concluded that the knowledge levels of these countries on edible insects are different from each other.

In a study by Dion-Poulin et al (2021) to explore the reasons why innovative student chefs are (or are not) willing to include mealworm meals in their cooking, the main perceived disadvantages of mealworm meal were texture (granular and irregular), odor, as well as low acceptability by consumers.

In a study conducted by Güneş and Özkan (2018) to provide an overview of consumers' perception and acceptance of insects as an alternative food source in Turkey, it was concluded that the majority of the individuals participating in the study did not consider insects as a food source and would consume them if they were religiously appropriate.

van Huis (2021), in his study to determine the expectations from insects as food and feed, emphasized that harvesting insects from nature is not an option in order to promote them as food and feed and emphasized the importance of breeding these animals.

In a study conducted by Özkan and Güneş (2020) to evaluate the perspectives on the use of edible insects as an alternative food source, the participants stated that they would consider insects as alternative food although they stated that they would not eat them if they were halal.

Halloran and Flore (2018), in their study to determine the views of aspiring chefs on insects in gastro, concluded that properly trained chefs are generally willing to experiment with different insect species in the kitchen.

Shockley et al (2018), in their study on the past, present and future uses of edible insects in North America, concluded that edible insects provide an overview of the applications and uses of edible insects as food in both whole and traditional forms, as well as more recent abstractions of insects for consumer snack food products.

Doğan and Çekal (2022) evaluated edible insects as a sustainable food alternative in gastronomy and concluded that edible insects should be considered as sustainable food sources due to their advantages in production compared to traditional protein sources.

Ceylan et al. (2020) conducted a study based on a sample of chefs and bartenders in Turkey to determine the relationship between new food phobia and creativity in the kitchen and found that there was a significant positive relationship between the participants' general neophobia and food neophobia level, and a significant negative relationship between general/food neophobia and creativity level.

Çiftçi et al (2020) emphasized four main findings of their study on overcoming food neophobia towards science-based baked foods. These findings are that it is necessary to conduct public disclosure activities,

Table 1 Demographic Characteristics of Participants

Source Person Number	Date of Birth	Profession	Education Status
K1	1986	Chef De Cuisine	High School
K2	1984	Chef De Cuisine	Associate degree
K3	1980	Chef De Cuisine	Secondary Education
K4	1975	Chef De Cuisine	Secondary Education
K5	1971	Chef De Cuisine	Secondary Education
K6	1978	Chef De Cuisine	Primary education
K7	1998	Chef De Cuisine	License
K8	1976	Chef De Cuisine	High School
K9	1985	Chef De Cuisine	High School
K10	1998	Chef De Cuisine	Master's Degree
K11	1970	Chef De Cuisine	High School
K12	1982	Chef De Cuisine	High School
K13	1978	Chef De Cuisine	License
K14	1985	Owner and Chef De Cuisine	High School
K15	1981	Chef De Cuisine	Associate degree

Source: Elaborated by Authors

develop appetizing foods, build culinary knowledge, and use an argument from authority to emphasize the way to overcome food neophobia towards science-based baked foods in the context of marketing.

3. Research Methodology and Findings

Qualitative research is one of the methods used to understand and analyze areas related to culinary culture and nutritional diversity. In this way, it is possible to have more in-depth information about the subject. In this study, data were collected through a semi-structured questionnaire. The questions were adapted from Büyüksalvarcı et al. (2016), Sandıkçı et al. (2015) and Seçim (2018). The adapted questions were revised by taking the opinions of four experts. The questions were finalized with the opinions of four academicians.

The participants of the study consisted of 15 actively working chefs in the central districts of Mersin province (Akdeniz, Yenişehir, Toroslar, Mezitli). While selecting the study group, factors such as the experience and specialization areas of the participants, different businesses, restaurant size and type were taken into consideration. The 15 business employees who accepted the research were contacted in advance and interviews were conducted between 10.11.2023 and 30.11.2023 by making an appointment on the day and time they were available. The interviews lasted 30-

35 minutes. The responses of the interviewees were recorded in writing and the evaluation process was carried out on the basis of these records. Ethics committee permission was obtained before the implementation phase of this research (Mersin University Ethics Committee dated 03/11/2023 and decision/number 233).

Table 1 shows the demographic characteristics of the participants. Accordingly, all of the participants are chefs and one of them is also a business owner (P14). In addition, their education level varies between primary school and undergraduate level.

Table 2 below shows the results of the word frequency analysis of the answers given in the question "What comes to your mind first when you think of edible insects?". When the answers given by the participants were analyzed, it was seen that the words grasshopper (f=9) and wolf (f=7) were mostly included in the answers. The words Far East (f=8) and ratchet (f=2) are also among the answers given. (Words mentioned less than 2 times are not included in the frequency tables.)

Have you had any training or experience in this area? Have you had the chance to taste or prepare an insect-based dish? When the answers given were analyzed, it was seen that only one participant (P11) received training and experienced insect-based dishes due to

Table 2 Frequency Analysis of What First Comes to Mind When Edible Insects are Mentioned

Word	Word length	Frequency	Degree
Grasshopper	7	9	1
Kurt	4	7	2
Far East	8	4	3
Ratchet	6	2	4

Source: Elaborated by Authors

her work in the Far East. P1, P2, and P4 stated that they took part in the production process for a while.

In Table 3 below, the word frequency analyzes of the answers given for the question "What would be the contribution to local gastronomy according to you?" are given. Accordingly, the word "I don't know" was used 4 times, while the word "not" was used 4 times. The words "maybe" and "could" were used 2 times each. Words used 1 time are not included in the table.

Table 3 Contribution of Edible Insects to Local Gastronomy Frequency Analysis

Word	Word length	Frequency	Degree
I don't know	10	4	1
no	5	4	1
maybe	5	2	3
may be	8	2	3

Source: Elaborated by Authors

When the answers given to the question "How do you evaluate the fact that edible insects are among the future food trends?" are analyzed, it is seen that the words "population" and "will not" were used the most (f=3). The words "will be" and "possibility" were used twice each in the surveys. When the word population was analyzed, it was determined that all 3 participants were of the opinion that edible insects could be among the trends with population increase.

Table 4 Edible Insects as a Food Trend Word Frequency

Word	Word length	Frequency	Degree
population	5	3	1
It won't happen	5	3	1
will be	6	2	3
probability	8	2	3

Source: Elaborated by Authors

Table 5 below shows the word frequency table for the answers to the question "What should be done to ensure general acceptance of edible insects in society?". In this table, the word that came first was education (f=6).

Table 5 What needs to be done for general acceptance of edible insects Word Frequency

Word	Word length	Frequency	Degree
Education	6	6	1
persuasion	4	2	2
our culture	11	2	2

Source: Elaborated by Authors

Table 6 shows the word frequencies of the answers to the question "If food resources are insufficient or decrease in the future, can edible insects be a solution in terms of sustainability?". According to this, maybe is

the most frequently used expression (f=5). However, when expressions such as "I don't know" (f=3) and "no way" (f=3) are evaluated together, it can be said that the positive perspective on this issue is relatively low.

Table 6 Frequency Analysis of Edible Insects in Case of Food Insufficiency

Word	Word length	Frequency	Degree
may be	8	5	1
I don't know	10	3	2
It won't happen	5	3	2
insufficient	8	3	2
Hunger	5	2	5
society	8	2	5

Source: Elaborated by Authors

In Table 7, when the answers to the question "What would be your customers' reaction to edible insect dishes, do you think they would be open to trying such dishes?" are analyzed, it is seen that the most frequently used word is not experiencing (F=15). The expression unacceptable was repeated 3 times. Therefore, according to the answers given, none of the participants think that there would be a positive reaction to edible insects.

The words do not experience and do not try were combined with the words reaction and reaction. All of the expressions containing the word "does not see" were reported as "does not accept" since they were preceded by the word "accept".

Table 7 Customers' Reaction to Edible Insects Word Frequency

Word	Word length	Frequency	Degree
they do not experience	15	13	1
Reaction	5	8	2
will not be accepted	6	3	3

Source: Elaborated by Authors

Table 8 shows the word frequencies of the answers to the question "Which creative presentation techniques would you suggest to integrate edible insects into the food menu?". Accordingly, it is seen that the words fusion (f=6) and blendable (f=2) are the most common. Therefore, it can be said that the participants think that the integration of edible insects into kitchens should be together with other dishes.

Table 8 Integration of Edible Insects Word Frequency

Word	Word length	Frequency	Degree
fusion	6	6	1
blendable	15	2	2

Source: Elaborated by Authors

Table 9 shows the Kappa analysis for the coding of the studies. The Kappa coefficient measures inter-rater agreement and can range from -1 to 1; a value of 1 indicates perfect agreement between observers (Franco & Napoli, 2016). Accordingly, 174 codes were consistent between the researchers and 27 codes were inconsistent. At the end of the coding, the Kappa value was found to be 0.85.

Table 9 Inter-Coder Agreement Kappa Analysis

		Encoder1		
		1	0	
Encoder 2	1	a=174	b=0	174
	0	c=28	0	28
		202	0	202

$P(\text{observed}) = P_o = a / (a + b + c) = 0.86$
 $P(\text{chance}) = P_c = 1 / \text{Number of Codes} = 1 / 19 = 0.05$
 $\text{Kappa} = (P_o - P_c) / (1 - P_c) = 0.85$

Source: Elaborated by Authors

Figure 1 shows the codes related to the answers given to the interview questions. Accordingly, the codes were combined under three categories. These are; perception of solutions to food shortages, perception of existing edible insects and acceptance of edible insects. The perception of solutions to food scarcity is divided into two thematic sub-codes. One of them is the contribution to local gastronomy and the other is the solution to food scarcity. In terms of contribution to local gastronomy, the codes of "maybe it will happen" and "it will contribute" stand out.

and "it will contribute" were created. When the negative responses were analyzed, it was found that the participants generally did not express that edible insects would contribute to local gastronomy. When the category of existing edible insects is analyzed, it is seen that the participants generally stated that their customers would not try edible insects. In the category of acceptance of edible insects, the responses were grouped under two sub-codes; integration of edible insects and acceptance in the community. When the codes are analyzed, it is seen that the participants gave answers related to fusion cuisine and blending as solutions. However, for the acceptance of edible insects in the society, answers related to education, cultural change and breaking prejudices were given.

Figure 2 shows the code frequencies generated by both researchers. Accordingly, it was determined that the participants gave answers in the codes of edible insects may be a solution to food shortages, will be a solution and will not be a solution. Accordingly, it can be said that the view that edible insects can be a solution in case of a food shortage is predominant. Regarding the contribution to local gastronomy, the code frequencies of "maybe it will" and "it will contribute" stand out. In addition, it is seen from the code frequencies that locusts come to mind most when it comes to edible insects.



Figure 1 Codes for Interviews

Source: Elaborated by Authors

Figure 2 shows the frequencies of the codes related to edible insects. According to this, it is seen that the code with the highest frequency is "can't try". When the other codes are evaluated together, it is seen that there is no other code with the same stability. Therefore, when an evaluation is made within their context, it can be said that the participants are in agreement that their customers will not try edible insects in the current situation, but there is no consistency among them about the changes it will bring to the kitchens in the future and the adequacy of edible insects as a solution.

Code System	Document	Document
Perception of Solution to Food Shortage		
Are Edible Insects the Solution?		
Maybe there will be a solution	4	6
There is no solution	5	5
It would be a solution	5	3
Contribution to Local Gastronomy		
Maybe it will happen	4	3
I don't know	5	4
It will not contribute	7	6
It will contribute	2	1
Current Edible Insect Perception		
Customers' Response to Insects		
Maybe they'll try	1	1
They don't try	16	15
When it Comes to Edible Insects, The First Thing That Comes to Mind		
Cricket	2	2
Seafood	2	2
Kurd	6	6
far east	4	4
Grasshopper	8	8
Acceptance of Edible Insects		
Edible insects are an invaluable part of the kitchen		
fusion kitchen	6	5
blend	6	5
Container of edible insects in society		
Education	6	5
culture change	6	5
Breaking down prejudices	2	2

Figure 2. Coding Frequencies for Edible Insects

Source: Elaborated by Authors

3. Conclusions and recommendations

This study aimed to explore in-depth the current perceptions of restaurant chefs in Mersin province towards the inclusion of edible insects in Turkish cuisine and their views on their future role in the event of a potential shortage. According to the results of the study, grasshopper was the species that most frequently came to mind among the participants when edible insects were mentioned. It has been emphasized in previous studies that grasshopper's high protein

content is particularly superior to other alternative foods and is considered as a suitable alternative to meet protein and fat needs (Paulin et al., 2020). Therefore, grasshopper, which the participants mentioned the most, stands out as the food with the highest protein content among other alternatives. Furthermore, grasshoppers have been reported to be one of the new food sources widely consumed in Africa, Asia and the Americas (Siddiqui et al., 2023). However, the success of these foods depends on changes in consumer attitudes and the development of acceptable food products (Paul et al., 2016).

When the responses are analyzed, it can be concluded that edible insects are not a viable food source for Turkish Cuisine in the current situation. According to Doğan and Çekal (2022), it is known that seafood consumption is common in Turkish cuisine, especially in coastal regions. Shrimp and grasshoppers are insect species with similar skeletal structure and nutritional content. Therefore, it can be said that the current views stem from the established food culture.

It was observed that the participants did not have a clear consensus on the contribution of edible insects to local gastronomy. At this point, there is a need for further research and promotion of the uses of edible insects in order for them to be considered as an alternative. In addition, the majority of the chefs surveyed strongly believed that customers would react negatively to insect-based dishes. Bakkaloğlu (2022) found that Turkish consumers' attitudes towards edible insects are influenced by disgust, food neophobia and health concerns. Therefore, it can be said that the inferences of the chefs in this study about their customers' potential attitudes towards edible insects are consistent with Bakkaloğlu (2022). At this point, it is necessary to develop effective communication strategies to raise public awareness and change perceptions.

Turkish cuisine is known to favor beef, lemon, yogurt, butter, oils and wheat flour, influenced by local cultural backgrounds and agricultural products (Özhan and Tuğrul, 2023). The results of this study also point to the possibility that edible insects may not be culturally accepted in the community. Therefore, it is predicted that radical changes such as edible insects will not be easy for Turkish Cuisine, which has a deep-rooted culture.

In conclusion, research on chefs and the general public in different countries suggests that edible insects tend not to be accepted by the public in terms of gastronomy and nutrition. However, it seems more likely that they can be integrated into Turkish cuisine through blending and fusion cuisine in a possible transition process.

This study has some limitations. First, due to its qualitative design, it is not appropriate to generalize the results. Also, the study focused on the food scarcity situation, where edible insects are considered as a solution. However, there are alternatives such as artificial meat. Therefore, other alternatives were not considered in this study. In future studies, it is expected that a comparative study of alternative solutions will be carried out and provide insights on foods that can be used in Turkish cuisine in case of a possible food shortage.

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