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Bugs on the Menu? Investigating the Determinants of Edible Insect Acceptance in Turkish Consumers

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Menüde Böcekler mi Var? Türkiyede'ki Tüketicilerde Yenilebilir Böcek Kabulünün Belirleyicilerinin Araştırılması	**Bugs on the Menu? Investigating the Determinants of Edible Insect Acceptance in Turkish Consumers**
Öz Bu çalışma, Türkiye'de yaşayan tüketicilerin yenilebilir böcek kabul düzeyini ve bu düzeyi etkileyen faktörleri incelemektedir. Araştırmada gıda neofobisi, çevre bilinci, sağlıklı beslenme farkındalığı, iğrenme, risk algısı, deneyim ve aşinalık değişkenleri ele alınmış ve yapısal eşitlik modellemesi ile analiz edilmiştir. Bulgular; gıda neofobisi, iğrenme, risk algısı, deneyim ve aşinalığın kabul üzerinde olumsuz bir etkiye sahip olduğunu, çevre bilinci ve sağlıklı beslenme farkındalığının ise olumlu bir etki yarattığını göstermektedir. Çalışma, tüketici algılarının psikolojik ve kültürel faktörlerden güçlü bir şekilde etkilendiğini ortaya koymaktadır. Olumsuz deneyimler ve aşinalık, kabulü artırmak yerine azaltabilmektedir. Bu çalışma, sürdürülebilir gıda alternatiflerine yönelik tüketici tutumlarının anlaşılmasına katkı sağlamaktadır.	**Abstract** This study examines the level of acceptance of edible insects among consumers living in Turkey and the factors influencing this level. The study examined the variables of food neophobia, environmental awareness, healthy eating awareness, disgust, risk perception, experience, and familiarity, and analyzed them using structural equation modeling. The findings indicate that food neophobia, disgust, risk perception, experience, and familiarity have a negative effect on acceptance, while environmental awareness and healthy eating awareness have a positive effect. The study reveals that consumer perceptions are strongly influenced by psychological and cultural factors. Negative experiences and familiarity may reduce rather than increase acceptance. This study contributes to the understanding of consumer attitudes toward sustainable food alternatives.
Anahtar Kelimeler: Yenilebilir böcekler, Sürdürülebilirlik, Gastronomi, Kabul düzeyi	**Keywords:** Edible Insects, Sustainability, Gastronomy, Acceptance
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1. Introduction

Sustainable food production and consumption has become an important global issue. The growing world population and environmental sustainability concerns have led to the need to transform and improve food production systems. In this context, there is a significant shift in future eating patterns and sources of nutrition (Ordonez & Egas, 2021). An inevitable surge in the demand for animal protein will be driven by the global population's projected growth to 9.6 billion people by 2050 (van Huis, 2016). Edible insects stand out as an important component of this transformation (Seyhan & Nakilcioğlu, 2022; Andaç & Tuncel, 2023). Turkey is geographically diverse country with a rich food culture. However, the sustainability of traditional food production and consumption habits globally is facing serious challenges. This highlights an extraordinary option when it comes to the utilization of edible insects as a potential food supply.

Edible insects are considered to have high nutritional value because they are rich in protein, vitamins and minerals (Rumpold & Schüler, 2013a; Womeni et al., 2009). Furthermore, insect farming represents an environmentally sustainable system because edible insects provide better water efficiency and energy utilization as compared to traditional livestock practices (Dobermann et al. 2017). Nevertheless, the familiarity and consumption of edible insects as food could evoke great prejudice based solely on the history of factors that fit into cultural, psychological and social factors (van Huis, 2016). This study aims to explore the potential acceptance of edible insect consumption among consumers in Turkey and to examine whether this potential varies according to demographic characteristics, food neophobia, environmental concern, health-conscious eating, disgust, and risk perception. Given Turkey's food culture and agricultural capacity, it will be interesting and intriguing to what extent edible insects will be an acceptable food source for Turkish consumers. In addition, one of the major objectives of this research will be to see if edible insects can be a contributor to food sustainability and security in Turkey.

The consumption of edible insects offers a sustainable and effective solution to meeting the increasing global demand for food, as they are not only highly nutritious but also provide significant economic and environmental advantages (Rumpold & Schüler, 2013b; Dobermann et al. 2017). In the gastronomic world, the consumption of edible insects is also becoming more prevalent with people consuming insects for not only nutrition purposes but to also try something different. Considering the number of people consuming edible insects worldwide and the important benefits of insects, it is not known how this situation is potentially accepted in Turkey. A study carried out in this context is significant both for contributing to the existing literature and for offering insights into the attitudes of Turkish consumers toward this emerging food source. Therefore the main problem of this study is: What is the level of acceptance of edible insects among consumers living in Turkey and how this acceptance is influenced by factors such as food neophobia, environmental awareness, healthy eating awareness, disgust, risk perception, experience and familiarity. A quantitative research design was used, and data were collected through a survey. The variables were considered and analyzed with structural equation modeling.

2. Conceptual Framework

2.1. Insects as Food

The global need for protein-rich foods is on the rise with population growth, urbanization and changes in dietary habits. However, traditional livestock farming is known to cause several problems, such as low efficiency in resource utilization, greenhouse gas emissions and animal rights issues. In this context, there is increasing interest in new protein sources that can meet nutritional needs while reducing environmental damage (Kaldırım & Keser, 2023). In particular, edible insects are among the remarkable alternatives with their nutritional value, Insects possess a rapid reproductive capacity and the ability to convert organic waste into protein sources. Entomophagy, or the practice of consuming insects, is a long-standing tradition observed in 113 countries, particularly prevalent in Africa, Asia, and Latin America. (Kouřimská & Adámková, 2016). Although more than 2,000 insect species are considered edible, caterpillars, bees, grasshoppers, and ants are among the most commonly consumed. Furthermore, species such as crickets, cicadas, leafhoppers, termites, dragonflies, and flies are also frequently consumed (van Huis, 2016).

In Europe, insect consumption is at very low levels and is considered culturally unacceptable or taboo (van Huis, 2016). "Consumer acceptance" in Western Nations has become one of the largest barriers to large-scale insect consumption. The majority of consumers in the west are generally negatively biased towards edible insects; however, many think it is the food of the future (Kim et al., 2019). For example, in a study by Demir and Altun (2021), the majority of people in Cyprus had a negative attitude toward edible insects; furthermore, with the world's population increasing and demand for beef, pork, and chicken all the more traditional meats increasing, edible insects, by way of contrasting senses, can be seen as an important alternative protein source.

2.2. Sustainability Advantages of Edible Insects

The research of edible insects as a sustainable food alternative is an important field of study looking at the growing need for sustainable food systems and practices for consumers and producers. As the global population continues to grow rapidly there is an increasing need for finding new and sustainable ways of food production. The reliance on traditional animal protein sources is placing a huge dependency on already limited natural resources, including finite resources such as water and land (van Huis et al., 2013). In this way, edible insects have the potential to become the alternative-source protein of look as they being recognized for this and potential food sustainability. Edible insects really have the potential for sustainability based on the way being nontraditional, they have many valuable characteristics for large-scale growing such as low environmental impact, proportionally high bioavailable protein content and lower green house gas emissions, making them a valuable sustainable food system (Oonincx & de Boer, 2012; van Huis, 2013).

Edible insects can help promote food sustainability through their and production by closing nutrient cycles, contributing to food security, reducing climate change, and biodiversity loss, and as such could help meet the SDG goals (Moruzzo et al., 2021). The environmental impact of insect production (raises) would be significantly lower than conventional meat production, especially with regards to resource usage, as producing conventional animal protein sources exposes each intersection of life cycle to potential vulnerabilities. Raising conventional animals for production purposes that may potentially impact ecosystems relies on large amounts of

water and feed inputs and associated land utilization (i.e., raising beef from cattle) (Miglietta et al., 2015). Insects, on the other hand, have a significantly smaller impact on the environment compared to these species of livestock; for example, if one were to reconstitute 1 kg of protein from beef, it would take about 15,000 litres of water, while insect farming uses, on average, 3,000 litres (Dobermann et al., 2017). Furthermore, less land area is needed to farm insects, thus reducing environmental impacts—issues like deforestation can be reduced as there's less land needed for large production of insects (Oonincx et al., 2010; Halloran et al., 2016A).

In terms of nutrition, insects also have relative advantages. Edible insects are specifically sought after for their protein content, but can also contain an impressive amount of micronutrients, including B vitamins, iron and zinc (Rumpold & Schlüter, 2013a). Consuming a range of insect species provides bioavailable protein and allows for daily protein and nutrient needs to be met by humans. In addition, insects contain valuable unsaturated fatty acids, essential amino acids, and high levels of fiber. These nutritional qualities can make insects a better and healthier protein source than traditional meat (Jongema, 2015; van Huis, 2013). In terms of organic waste recycling, insects have foilable systems in salient food systems. Specifically, insects such as black soldier flies larvae can convert organic waste into high protein biomass, and this is an important addition to environmental waste management and better organ hazard to waste (Veldkamp et al., 2012; Halloran et al., 2016). Insects also provide organic waste to positive easier management, and successful circular food systems, leading to less waste. This can improve productivity, and decrease the environmental burden for agriculture and the food industry (van Huis, 2013).

Edible insects could also add biodiversity, ecological functions (pollination, and aerating topsoil), and potentially improve wild insect populations (an imperative ecological balance; Payne & Van Itterbeeck, 2017). Insects are high in protein, essential amino acids, and micronutrients. Insects within our diets can alleviate malnutrition and increase diversity in food in areas of food insecurity (Aidoo et al., 2023). Insect farming is also being perceived as a useful undertaking for economic development and access to sufficient food in the developing world, as the startup and operational cost are typically very affordable and manageable. Low capital requirements, combined with higher human labor, can support localized economies in rural areas, and factors into the workforce (Halloran et al., 2016; Yen, 2009). Additionally, insects are available as an accepted form of food, as a food source in certain cultures; encouraging food practices for consumption of insects may provide security to food practices around the world.

2.3. Acceptance of Edible Insects in Europe and the US

Cultural and consumer acceptance of edible insects is a complex phenomenon that involves an array of factors, ranging from psychological concerns to socio-cultural concerns. The issue of acceptance of edible insects in Western society has been raised in the last few years as we search for ways to source and sustain food in an environmentally sustainable manner and efficiently use resources and sources of protein. Historically, food traditions and cultures in industrialized areas such as Europe and North America have developed an aversion to eating insects. However, population growth, food safety concerns, and potential negativity on a large scale regarding the environment has opened up opportunities for acceptance of novel food. In this context, insects as potential alternative solutions for sustainable food production are beginning to be discussed and researched in the Western world (van Huis et al., 2013).

One of the main impediments to the acceptance of edible insects in Western societies has historically been cultural influences and barriers. In Europe and North America, insects are

viewed predominantly as pests, or undesirable. As pests, insects are associated with hygienic and health concerns. Studies in the field of food psychology have demonstrated that humans exhibit caution over new or strange foods, and even demonstrate some level of "disgust" reaction (Rozin et al., 1986). One of the biggest impediments to the acceptance of edible insects in Western societies is disgust, and food neophobia. Cultural norms and individual psychological tendencies will drive the disgust reaction and subsequently influence consumers' willingness to consume edible insects (Tan, 2017). The understanding of what is "appropriate" food is different in every culture. Where it is normal to consume insects, it is more socially acceptable. There is more resistance in Western cultures where insects have never been part of the food culture (Tan & Fischer et al., 2015). In this sense, the consumption of insects calls for wider changes in Western diets. Research suggests that the way in which insects are presented in the food chain is important for changing this perception, for example, offering insects in an insect product- flour, powder, or protein bars rather than insects directly, can increase the acceptance of insects (Verbeke, 2015).

Adoption of an environmentally aware, sustainable lifestyle in Europe and America in recent years is another reason for increased acceptance of eating insects. Insects have lower water and feed requirements than traditional meat sources and produce less waste and greenhouse gas emissions than traditional meat sources (Oonincx & de Boer, 2012). These apparent environmental benefits position basal insect consumption on the policy agenda in the Western world- as a key tool for combating climate change (Miglietta et al., 2015). In New Year 2018, the European Union began legal regulation of insects used as a food source and approval for the marketing and useable of some insects as food. Legal regulations offered the potential for the widespread consumption of edible insects and increased confidence in food production standards for consumers (EFSA, 2015; EFSA, 2020). Health and nutritional benefits are also motivating acceptable of insect-based foods in Western nations. The protein, vitamins, minerals and unsaturated fatty acids in insects are very bioavailable (Rumpold & Schlüter, 2013a). For individuals who adopt a healthy and balanced dietary approach, insect-based proteins offer an alternative that is nutrient dense but low in caloric value, increasing interest and nearly fanaticism for insect-based produces, especially among athletes, health-conscious individuals and groups who are interested in environmentally-friendly dietary models (Jongema, 2015).

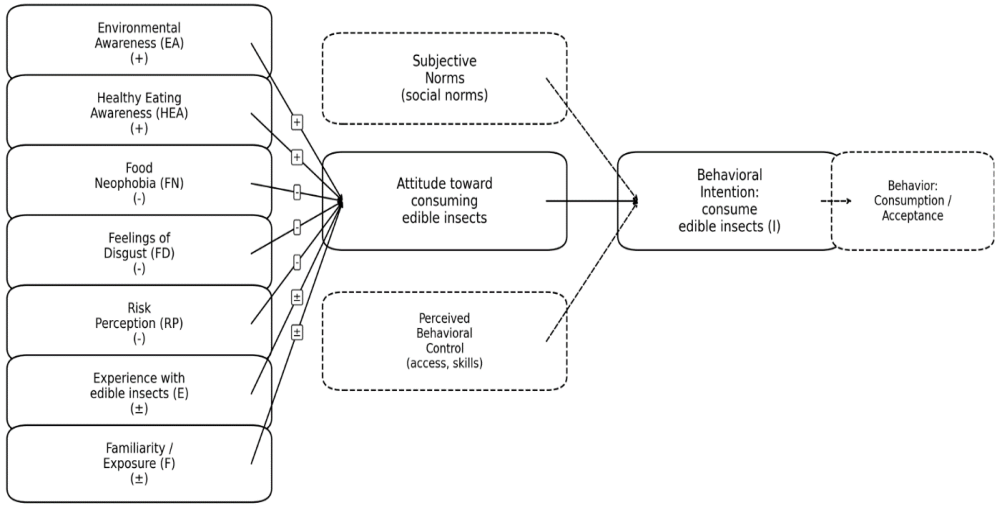
Numerous influences affect the attitudes toward edible insects in Western societies. Personal experience/glut of edible insects can lead to a greater acceptance, whether the experience was had directly or through cultural practice, and experience will be a dominant component in how people engage with consumer attitudes towards insects (Tan, 2017). Also, the taste, texture, and aroma of insect-based foods will affect acceptance; sensory characteristics such as taste, appearance and texture matter to consumers. One way of increasing acceptance is to develop insect-based produces that fulfil consumers' sensory preferences (Tan & House, 2018). Begin with insect-based produces that conceal the insect by using insects in the form of familiar food-based products so consumers do not have to engage in a visible way with the insect, thereby diminishing or allaying the fear of eating insects. With these products, it is easier to market the attributes of tasty, convenient and health-conscious edible insect-based produces (Kauppi et al., 2019). Knowledge of the nutritional value, environmental impact, and ethical considerations of consuming edible insects can play a positive part in acceptance, and education and marketing that employ these supportive

elements as a to push the shift in perceptions (Alhujaili et al., 2023). Strategies for changing perceptions can be more effective if they consider specific cultural contexts and consumer segments. Involving people in strategies to develop a new expression of food can be complicated, and addressing the different barriers and motivators specific to various cultures is important (Brunner & Nuttavuthisit, 2019). Education is equally important in changing consumer attitudes. The topical nature and understanding of edible insects' sustainability, nutritional justification and safety can dismiss misinterpretations and improve acceptance (Żuk et al., 2022).

3. Theoretical Framework

Individuals' acceptance of edible insects, as possible foodstuffs, is not only influenced by their attitudes and beliefs, but also by cultural, psychological and environmental determinants. This study draws on several consumer behaviour theories, including the Theory of Planned Behaviour (TPB) (Ajzen, 1991). TPB suggests that behaviour is predicted based on intentions, which are modified by three factors: attitudes, subjective norms, and perceived behavioural control. While TPB has been applied in a variety of contexts, it is useful to consider the extent to which it would shape consumer's intentions towards edible insects. For example, it is reasonable to assume that an individual with a more favourable attitude towards edible insects based on its perceived environmental sustainability properties, is likely to eventually consume insect-based food products. In addition, positive subjective norms from the social context may strengthen intentions to consume these products. The consumption intentions within the TPB model could also include influences of perceived behavioural control, such as issues of access, or limitations to the respondents' knowledge of cooking techniques (Verbeke, 2015). Overall, TPB can be used in this study to explore the influences of some of the variables - environmental awareness, health eating awareness and social norms - and their effects on behavioural intentions.

Figure 1: Conceptual model based on the Theory of Planned Behavior (TPB).



This model demonstrates that behavioral intention toward edible insect consumption is explained by the core components of the TPB: attitude, subjective norms, and perceived

behavioral control. The variables addressed in the study (environmental awareness, healthy eating awareness, food neophobia, disgust, risk perception, experience, and familiarity/exposure) are positioned as precursors that shape intention, particularly through attitude, by influencing individuals' beliefs and evaluations regarding edible insect consumption. The strengthening of intention represents the path to consumption/acceptance behavior in the model.

Lastly, an idea called food neophobia (Pliner & Hobden, 1992), may explain the fear or dislike of new and novel foods. Food neophobia posits that greater neophobia would have an inverse relationship to a person's attitude towards innovative food products (such as edible insects). However, it can also be noted that increased familiarity with a product in terms of innovative consumer behaviour, can reduce this fear and resistance to new foods. In this study, food neophobia may refer to attitudes clearly indicating negative views about edible insects as food. Furthermore, the familiarity aspect could be explained as the respondents' familiarity was likely part of the reason why this was related to negative views (Damsbo-Svendsen et al., 2019). Rozin and Fallon (1987) were able to show that feelings of disgust were the primary drivers of individuals' food choices. Feelings of disgust represent a major obstacle to the consumption of edible insects in mainly Western countries. The use of insect-based foods in a processed manner (e.g., flour, protein bars) can create greater sensory acceptance (Hartmann et al., 2015). In the study, this could be elaborated with respect to the impact on consumer behaviour and how potential disgust barriers could be mediated with greater sensory familiarity.

The risk perception theory postulated by Slovic (1987) is predicated on the argument that people evaluate the risk or benefits of new and unfamiliar products, which ultimately informs or influences a person's acceptance of them. Hygienic safety and health risks of edible insects, or perceptions of, as they relate to actual insect consumption should also directly relate to consumers' attitudes toward edible insects. An inquiry could be framed that examines risk perceptions impact on consumption intentions, as well as environmental benefits in an effort to balance risk perceptions. Value-Belief-Norm Theory (VBN) explains individuals environmental behaviours on the basis of their values, beliefs and norms (Stern, 2000). It is likely that environmentally-conscious individuals would positively influence their evaluations of edible insects' environmentally friendly characteristics, and potentially promote edible insect consumption behaviour. This theory could adequately describe the potential variability of the impact of environmental consciousness on insect consumption intention. This theoretical framework is designed to provide a multi-dimensional way of exploring the multitude of influences on edible insect consumption intentions and the interconnectedness of these influences. From the above theories, it is possible to develop hypotheses for the study, and this framework provides an appropriate context for the interpretation of the findings.

4. Method

A quantitative, correlational survey model was utilized in this study. This method is favored by researchers in studies that seek to identify the attitudes, thoughts, beliefs and views of individuals in large masses towards a variety of variables and the interaction between many variables (İslamoğlu & Alnıaçık, 2014). This research attempts to uncover the potential of consumer's of Turkey to accept insect consumption, and whether that potential can be measured according to other variables such as demographic variables, neophobia, environmental awareness, healthy eating awareness, disgust, risk perception and familiarity variables.

4.1. Hypothesis Development

H1: A statistically significant connection exists between Food Neophobia and Level of Acceptance of Edible Insects

Food neophobia is defined as fear of and rejection of new or unfamiliar foods. Individuals that are higher in food neophobia may tend to view unfamiliar or new foods as a more negative experience and may be less willing to try new foods (Pliner & Hobden, 1992; Barrena & Sánchez, 2013). This characteristic also appears to be a determinant factor in insect consumption and that neophobic individuals exhibited low levels of acceptance of insects (Megido et al., 2014).

H2: A statistically significant connection exists between Level of Environmental Awareness and Level of Edible Insect Acceptance

There is some evidence from studies about the environmental effects of edible insects that environmental awareness may lead to acceptance of this food source. The increased use of insects as an environmentally sustainable protein source contributes toward a smaller carbon footprint (Miglietta et al., 2015; van Huis et al., 2013). Research indicates that increased environmental awareness leads to a more positive attitude towards sustainable food sources, and an increased willingness to try new foods (Verbeke, 2015; Schlup & Brunner, 2018). If environmental awareness is increased, it follows that individuals will develop more positive attitudes towards edible insects.

H3: A statistically significant connection exists between Healthy Eating Awareness and Level of Acceptance of Edible Insects

Edible insects are viewed a safe, nutritious food option with high protein content (Rumpold & Schlüter, 2013a). Individuals with healthy eating awareness may show more interest in alternative protein sources than those who do not, and want to forage for foods with higher nutrition, low fat, and low carbohydrates (Hartmann & Siegrist, 2016; Ruby et al., 2015). The awareness of health is a competetive consideration for an individual's food choice when ultimately selecting food, and contributes to speed adoption of innovative, safe, healthy products (Rozin et al., 2012). Healthy eating awareness is, therefore, hypothesised to have a positive influence on the level of the acceptance of edible insects.

H4: A statistically significant connection exists between Feelings of Disgust and Level of Acceptance of Edible Insects

Disgust represents one of the biggest psychological barriers that individuals display towards edible insects. Disgust may lead to hesitancy to accept the food, or even consumer reluctance, (Rozin & Fallon, 1987; Hartmann et al., 2015). The research shows that disgust exerts a strong negative influence on food consumption (Martins & Pliner, 2005). If an individual tipifies with a high level of disgust, it is hypothesised the level of acceptance of edible insects will be low.

H5: A statistically significant connection exists between Risk Perception and Edible Insect Acceptance Level

There have been comments in the literature regarding the fact that an individual's perceived risk level plays an important role in the acceptance of edible insects. When opting to consume new and alternative foods, the contribution of health and safety to the perception of risk may provide the perceived constraints to the individual to develop negative attitudes towards the food options (Lobb, 2005; Kahan, 2012). Insect consumption exhibits a similar occurrence, and individuals with high levels of risk perception reject this food option (Verbeke, 2015). It is,

therefore, assumed that perceived risk as a function of perceived risk factors negatively impacts the acceptance of edible insects.

H6: A statistically significant connection exists between Experience and Edible Insect Acceptance Level

An individual's experiences impact the acceptance of edible insects. The research indicates that direct experiences with a product can fill in the knowledge gaps, reduce viewed perceived risk and strengthen positive attitudes (Verbeke, 2015; Tan et al., 2016). Two experienced edible insects in personal culinary experiences, there is a strong potentially positive attitude towards the product (Schösler et al., 2012). However, this does not mean that experience will always increase the level of acceptance. In some cases, individuals may have negative experiences associated with edible insects, and perhaps a series of negative experiences. Taste experience, texture experience, or type of consumption experience can aggravate perceptions of the edible insect, and thus diminish acceptance (La Barbera et al., 2018). Specifically, consumers may display a form of sensory aversion individuals in certain rare cases, leading to rejection of an unusual food, such as edible insects (Hartmann et al., 2015).

H:7 There is a Significant Relationship between Familiarity and Level of Acceptance of Edible Insects

Familiarity positively affects individuals' perceptions and acceptance of unusual foods. Individuals who are familiar with or have encountered edible insects perceive lower perceived risks and perceive these products as more normalized (Verbeke, 2015). In addition, for some individuals, familiarity may lead to greater exposure to the negative attributes of edible insects (e.g., aesthetics, hygiene, or contravention of cultural norms) and reinforce these negative perceptions (Rozin & Fallon, 1987). Elements such as the appearance of insects or the way they are consumed may elicit a strong disgust response in individuals, leading to a decrease in acceptance as familiarity increases. Hartmann et al. (2015) showed that familiarity can sometimes further reinforce prejudices and negative perceptions.

4.2. Population and Sample

This study's target population was consumers living in Turkey. As accessing the entire population was not feasible, the research employed an approach combining two non-probability sampling methods: convenience and snowball sampling. Considering the advantages of convenience sampling such as being more economical compared to other sampling techniques, allowing to collect a lot of data in a short time, and the sampling units being accessible and easy to select, this sampling technique was preferred because it overlaps with the purpose of the research (Yazıcıoğlu & Erdoğan, 2004).

4.3. Data Collection Tool

A questionnaire form consisting of 8 scales served as the instrument for data collection in the study. The questionnaire was preferred because it is suitable for collecting data from large and dispersed samples such as in this study, has high applicability and has the ability to provide standardized data (Creswell & Miller, 2000). In the first part of the questionnaire, based on the assumption that the participants would not have sufficient prior knowledge about edible insects and their consumption, a brief information text about edible insects was included. Sample visuals of processed and unprocessed edible insect produces were presented. Then, the sections designed to measure the level of acceptance of edible insects and the variables of

food neophobia, environmental awareness, healthy eating awareness, risk perception, disgust, familiarity and experience that are thought to affect this variable were included.

4.4. Data Collection Process

The data collection process was conducted through an online survey application 'Google Forms' in order to reach more people faster, taking into account the difficulty of reaching the sample in question. Participants received invitations to complete the survey via email, social media, and other online platforms. The online survey was open from 01/06/2024 to 16/07/2024 and the data collection process lasted for 46 days in total. No time limit was imposed on the participants to complete the survey. No personal identifying information was collected from the participants and the confidentiality and anonymity of the participants were protected. At the end of the data collection process, 524 people were reached, but the analyses were carried out with the data of 502 participants who completed the questionnaire form in a healthy and complete manner.

4.5. Data Analysis

The data analysis began with a frequency analysis to summarize the participants' demographic information and create a statistical overview. To ensure the questionnaire was reliable, The internal consistency of the scale's items was assessed using Cronbach's Alpha coefficient. Because the questionnaire was adapted from international literature, its validity was tested using factor analysis. Finally, structural equation modeling (SEM) was employed to test the research hypotheses.

5. Findings

5.1. Findings Regarding the Demographic Information of the Participants

The demographic profile of the participants shows that the majority were female (59.8%) compared to male (40.2%). Most of the respondents (59.2%) were in the 26-45 age range. In terms of education, the most represented levels were high school graduates (33.7%) and undergraduate degree holders (35.9%). In terms of income distribution, the largest group is in the 17,000-29,999 TL income range with 40.8%. In terms of sector, 42% of the respondents work in the private sector, 29.1% work in the public sector and 28.9% do not work. Regionally, the highest participation was from the Marmara Region (24.1%), followed by Central Anatolia (19.9%) and the Aegean Region (16.1%). The findings regarding the demographic characteristics of the participants are summarized in Table 1.

Table 1: Findings on demographic characteristics of the participants.

Demographic Characteristics	Frequency (N)	Percentage (%)
Gender		
Female	300	59,8
Male	202	40,2
Age		
18-25	134	26,7
26-35	160	31,9
36-45	137	27,3
46-55	47	9,3
56-65	15	3

65 and above	9	1,8
Education status		
Primary School	40	8
High School	169	33,7
Associate Degree	92	18,3
License	180	35,9
Postgraduate	21	4,2
Income		
0-16999	131	26,1
17000-29999	205	40,8
30000-44999	89	17,7
45000-59999	46	9,2
60000-74999	24	4,8
75000 and above	7	1,4
Sector		
Public	146	29,1
Private	211	42
Not working	145	28,9
Region		
Marmara	121	24,1
Aegean	81	16,1
Mediterranean	72	14,3
Central Anatolia	100	19,9
Black Sea	39	7,8
Eastern Anatolia	33	6,6
Southeast Anatolia	56	11,2

As can be seen in the table, women and individuals between the ages of 26 and 45 are predominant among the respondents, educational level is mostly high school and above, and income distribution is concentrated in middle income groups.

5.2. Findings on Validity, Reliability and Hypothesis Testing

To select the appropriate analytical methods, a normal distribution test was first performed on the data. The skewness and kurtosis values for the scale items were found to be within the reference range of +1.5 to -1.5. This result confirmed that the research data followed a normal distribution, making it suitable for analysis with parametric tests.

Following the normal distribution test, the study performed validity and reliability tests on the scales. Construct validity was assessed using Exploratory Factor Analysis (EFA). The data's suitability for factor analysis was confirmed by a Kaiser-Meyer-Olkin (KMO) measure of 0.867 and a significant Bartlett's Test ($p<0.001$). To determine the factor structure, a principal component analysis was conducted using a Direct Oblimin rotation method. In this analysis, factors were retained if their eigenvalue was greater than 1, and items were required to have a factor loading of at least 0.50 to be considered significant (Büyüköztürk, 2018).

The results from the Exploratory Factor Analysis (EFA) and Cronbach's Alpha tests are detailed in Table 2. The EFA confirmed an eight-factor structure, with each scale loading onto a single dimension as in their original forms. This model explained 78.849% of the total variance. The reliability analysis showed an overall Cronbach's Alpha value of 0.849 for the study. Together, these results indicate that all the scales used are theoretically coherent, valid, and reliable (George & Mallery, 2010).

Table 2: EFA and Cronbach Alpha Values of the Scales

Statements	Factor Load	Variance Explained	Core Value
Risk Perception		26,891	9,143
RP1	0,820		
RP2.	0,903		
RP3	0,907		
RP4	0,869		
RP5	0,915		
RP6	0,909		
RP7	0,916		
RP8	0,895		
Food Neophobia		11,132	3,785
FB1	0,835		
FB2	0,844		
FB3	0,821		
FB4	0,847		
FB5	0,856		
FB6	0,847		
Familiarity		10,976	3,732
F1	0,701		
F2	0,917		
F3	0,922		
F4	0,907		
Environmental Awareness		9,626	3,273
EA1	0,677		
EA2	0,839		
EA3	0,851		
EA4	0,722		
EA5	0,723		
Feeling of Disgust		6,03	2,05
FD1	0,907		
FD2	0,907		
FD3	0,904		
Healthy Eating Awareness		5,731	1,949
HEA1	0,892		
HEA2	0,848		
HEA3	0,904		
Experience		5,079	1,727

E1	0,789		
E2	0,887		
E3	0,806		
Intention		3,384	1,15
I1	0,856		
I2	0,862		
Total explained variance		**78,849**	
Cronbach's Alpha		**0,849**	

Based on the study's purpose and the relevant literature, the resulting eight-factor structure was labeled as: risk perception, food neophobia, familiarity, environmental awareness, disgust, healthy eating awareness, experience, and intention. After the exploratory factor analysis, a confirmatory factor analysis (CFA) was conducted to verify this eight-factor model. The CFA was then assessed using the most widely accepted standard fit criteria from the literature. (Hair et al., 2015).

Table 3: CFA Goodness of Fit Index Statistical Results for the Research Data

Compliance Criteria	Good Fit	Acceptable	Model Value	Harmony
x^2/sd	0 ≤ x 2 / sd < 2	2 ≤ x 2 / sd ≤ 5	3,403	Acceptable
RMSEA	0 ≤ RMSEA < 0.05	0.05 ≤ RMSEA ≤ 0.10	0,069	Acceptable
SRMR	0 ≤ SRMR < 0.05	0.05 ≤ SRMR ≤ 0.10	0,037	Good
NFI	0.95 < NFI ≤ 1.00	0.90 ≤ NFI ≤ 0.95	0,94	Acceptable
CFI	0.97 < CFI ≤ 1.00	0.95 ≤ CFI ≤ 0.97	0,96	Acceptable
IFI	0.95 < IFI ≤ 1.00	0.90 ≤ IFI ≤ 0.95	0.96	Good
NNFI	0.97 < NNFI ≤ 1.00	0.95 ≤ NNFI ≤ 0.97	0,95	Acceptable
RFI	0.95 < RFI ≤ 1.00	0.90 ≤ RFI ≤ 0.95	0,93	Acceptable

The overall goodness-of-fit statistics indicated that the measurement model was good and acceptable. To ensure construct validity, the analysis evaluated three key metrics: standardized factor loading, combined reliability (CR), and average variance explained (AVE). The study's results, as shown in Table 4, successfully met the established thresholds from the literature. Specifically, all factor loadings (0.803-0.962) were above the recommended 0.50 minimum , all combined reliability values (0.875-0.989) exceeded the 0.70 standard , and all average variance explained values (0.701-0.968) were greater than the suggested 0.50 cutoff. All these values reveal that the convergent validity of the factor structures is achieved, that is, the measurement is valid and reliable (Hair et al. 2015; Fornell & Larcker 1981).

Table 4: Confirmatory Factor Analysis Results for the Scales

Factors	Factor Load	C.R.	A.V.E.
Risk Perception		0.974	0.822
RP1	0,949		
RP2	0,959		
RP3	0,958		
RP4	0,943		
RP5	0,955		

RP6	0,954		
RP7	0,962		
RP8	0,949		
Food Neophobia		0.951	0.766
FN1	0,863		
FN2	0,858		
FN3	0,916		
FN4	0,854		
FN5	0,877		
FN6	0,862		
Familiarity		0.983	0.936
F1	0,938		
F2	0,951		
F3	0,960		
F4	0,938		
Environmental Awareness		0.937	0.750
EA1	0,817		
EA2	0,832		
EA3	0,845		
EA4	0,834		
EA5	0,833		
Feeling of Disgust		0.989	0.968
FD1	0,942		
FD2	0,952		
FD3	0,944		
Healthy Eating Awareness		0.939	0.838
HEA1	0,865		
HEA2	0,874		
HEA3	0,901		
Experience		0.875	0.701
E1	0,804		
E2	0,884		
E3	0,803		
Intention		0.984	0.959
I1	0,804		
I2	0,818		
Total Variance Explained		**86,364**	

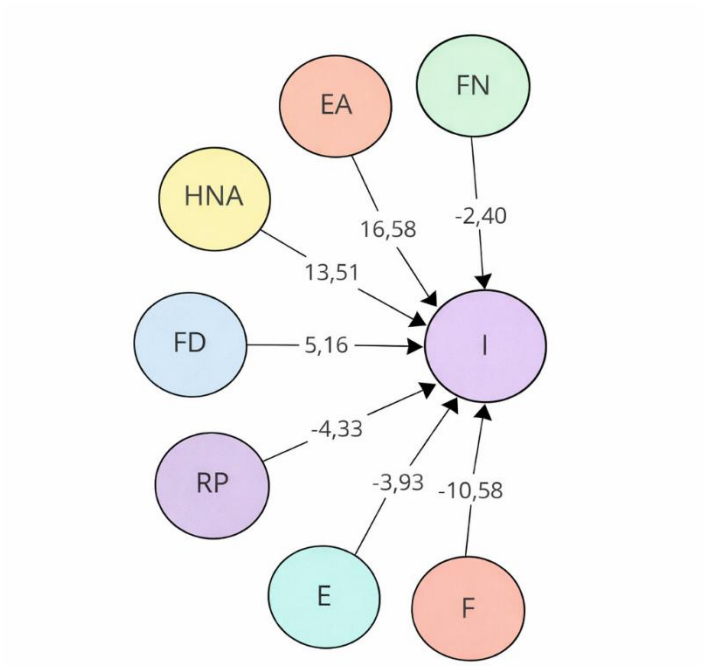
Structural equation modeling (SEM) was employed to test the research hypotheses and determine if significant interactions existed between the variables, as proposed in the theoretical model. To assess whether the hypotheses were supported, their corresponding t-values were evaluated. The results of this SEM analysis, detailed in Table 5, were used to examine the effects of various factors on the intention to consume edible insects.

Table 5: Structural Equation Model Results Regarding Research Hypotheses

Hypotheses	Relationship	Standardized Factor Loadings	T value	Conclusion
H1	**FN→I**	-0.11	-2.40*	**Supported**
H2	**EA→I**	0.55	16.58*	**Supported**
H3	**HEA→I**	0.49	13.51*	**Supported**
H4	**FD→I**	-0.22	-5.16*	**Supported**
H5	**RP→I**	-0.19	-4.33*	**Supported**
H6	**E→I**	-0.19	-3.93*	**Supported**
H7	**F→I**	-0.41	-10.58*	**Supported**

The structural model created for the findings of the hypothesis tests is presented in Figure 1 below.

Figure 2: Research Model. I: Intention to Consume Edible Insects, FN: Food Neophobia, EA: Environmental Awareness, HEA: Healthy Eating Awareness



As can be seen in the figure above, the theoretical model created within the framework of the research was confirmed by the structural model and all research hypotheses were accepted.

6. Discussion and Conclusion

The findings reveal the importance of the factors influencing the level of edible insect acceptance and some of the complexities in this area. Food neophobia has a negative effect on acceptance (β= -0.11, t = -2.40). This finding supports that individuals' fear and inhibition

towards new and unfamiliar foods make it difficult to adopt innovative foods such as edible insects (Pliner & Hobden, 1992).

Environmental awareness positively affected the level of acceptance (β = 0.55, t = 16.58). This suggests that individuals who are aware of environmental sustainability are more likely to evaluate edible insects positively (van Huis et al., 2013). Disgust (β= -0.22, t = -5.16) and risk perception (β = -0.19, t = -4.33) were found to be strong psychological barriers that negatively affect acceptance (Rozin & Fallon, 1987; Verbeke, 2015).

However, experience (β = -0.19, t = -3.93) and familiarity (β = -0.41, t = -10.58) were found to negatively affect the level of acceptance. Although experience and familiarity are generally considered as factors that increase acceptance in the literature (Tan et al., 2016), negative experiences or perceptions were found to be effective in this study. This result suggests that especially sensory dissatisfaction and negative taste perception may permanently affect individuals' attitudes towards such products (Hartmann et al., 2015). Although experience may be effective in reducing perceived risks, a negative experience may reverse this effect and reinforce rejection behavior in individuals. This highlights the importance of sensory characteristics and presentation of insect-based foods on consumer acceptance. The negative effect of familiarity on acceptance suggests that the more individuals are exposed to edible insects, the more they may recognize negative aspects of these products. For example, the aesthetic appearance of insects or their culturally contradictory characteristics may become more prominent with increased familiarity (Rozin & Fallon, 1987).

Theoretical Outputs

This research contributes to the literature by analyzing the various factors that influence the acceptance of edible insects among people living in Turkey. The findings indicate that the acceptance of edible insects is directly influenced by an individual's psychological, social, and environmental awareness levels. Specifically, food neophobia, disgust, and risk perception were identified as having a negative impact on acceptance, representing major barriers that limit the consumption of edible insects. The results suggest that the resistance mechanisms individuals have to consuming new and novel foods merit further research. In contrast the level of environmental awareness positively supported a stronger attitude towards edible insects, and confirmed the critical role environmental sustainability awareness plays towards innovative foods. This supports the body of literature indicating environmental motives are an important aspect of consumer behavior. The negative effects of familiarity and experience constructs, which are suggested to have a positive effect in the literature, indicate that the effects of these variables may be dependent on cultural perceptions and individual knowledge.

Practical Outputs

The study's results also have practical applications for developing products, marketing, and communication strategies designed to boost consumer acceptance of edible insects. One key recommendation is that enhancing the sensory profile of products—such as their taste, texture, and appearance—could help offset negative experiences and improve consumer reception. Utilizing processed product formats could lessen people's aesthetic concerns and positively influence their attitudes towards such products. Furthermore, awareness raising campaigns focused on the environmental benefits and nutritional characteristics of edible insects could serve as positive ways to change people's perceptions of these products. These campaigns can specifically target sustainability orientated individuals. Because consumer segments are diverse

in their knowledge and beliefs, it is important that communication strategies are not only tailored for the different segments. For example, nutritional values can be emphasized for health-conscious individuals, while sustainability can be emphasized for environmentally conscious individuals.

Limitations and Recommendations

Although this study comprehensively addresses the factors affecting the acceptance level of edible insects, it has some limitations. First of all, the fact that data for the study were gathered during a defined time frame and from a specific sample group may limit the generalizability of the results. The demographic characteristics, cultural background and dietary habits of the individuals participating in the study may cause the findings to vary for different groups. Comparative studies with different socio-cultural groups will contribute to the evaluation of the validity of the results obtained in different communities. In addition, the fact that the scales used in the study are intended to measure individuals' attitudes and perceptions may not directly reflect actual consumption behaviors. It should be noted that there may be a divergence from the attitudes declared by the participants in the questionnaire or interview and the consumption behaviors they exhibit in actuality. Subsequent studies or observational investigations may alleviate this limitation by explicitly studying consumer behavior. The variables examined in the original study comprise only a portion of the multitude of factors that contribute to the acceptance of edible insects. In particular, areas such as observed price, socialization and media representations may mediate individuals' acceptance of these products. Future studies may strive to create more comprehensive models that incorporate those areas, while also investigating the multitude of mechanisms that shape acceptance.

Future research should also examine, in greater context, the cultural and demographics differences in individual determinants of acceptance of edible insects. It would be worthwhile to examine how experience and familiarity differentially mediate acceptance across cultures and examine the contributions of individuals' acceptance based on social norms and membership group. The role of sensory attributes on individuals' perceptions should also be explored as well. Specifically, differences based on acceptance levels in items that are processed and to natural forms. Alternatively, the influence of the media portrayals and communications strategies may have on individual perceptions of these products must be investigated as well. Development of strategies to mitigate negative aspects of media portrayals could support more effective communication strategies to promote acceptance of some novel food products.

In conclusion, this paper contributes to the current literature in the area of individual acceptance and consumption behaviors with respect to edible insects by examining both contextualized individual, psychological and cultural factors that would play a meaningful role in both acceptance and consumption of edible insects. It is important that these types of studies get support from interdisciplinary teamwork in order to create strategies for new and sustainable food systems.The results of the study provide valuable insights at both theoretical and practical levels to transform consumer perceptions and promote wider acceptance of edible insects.

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Extended Summary
Bugs on the Menu? Investigating the Determinants of Edible Insect Acceptance in Turkish Consumers

As the global population continues its rapid expansion, projected to reach 9.6 billion by 2050, the demand for sustainable and secure food sources has become a critical international issue. Traditional livestock farming, a primary source of animal protein, places immense strain on natural resources like water and land while contributing significantly to greenhouse gas emissions. In response to these pressing environmental and food security challenges, researchers and policymakers are exploring alternative protein sources, with edible insects emerging as a highly promising solution. This study, "Bugs on the Menu? Investigating the Determinants of Edible Insect Acceptance in Turkish Consumers," delves into this area by examining the attitudes of consumers in Turkey, a nation with a rich and diverse culinary heritage, toward the consumption of insects. The research aims to identify the key psychological, cultural, and perceptual factors that shape their willingness to accept this novel food source.

The study employed a quantitative, correlational survey model to gather data from 502 consumers across Turkey. The researchers utilized convenience and snowball sampling methods to distribute an online questionnaire. This survey was designed to measure the participants' level of acceptance of edible insects and assess the influence of several key variables. These included food neophobia (the fear of trying new foods), environmental awareness, healthy eating awareness, feelings of disgust, risk perception (related to health and safety), and prior experience and familiarity with insect consumption. The collected data were analyzed using structural equation modeling (SEM) to test the hypothesized relationships between these factors and the intention to consume edible insects. The theoretical framework for the study was built upon established consumer behavior theories, including the Theory of Planned Behavior, which connects attitudes and social norms to behavioral intentions.

The findings of the study revealed a complex interplay of factors influencing the acceptance of edible insects among the Turkish participants. As hypothesized, environmental awareness and healthy eating awareness were found to have a strong positive effect on acceptance. Consumers who were more conscious of sustainability and the nutritional benefits of their food choices were significantly more open to the idea of incorporating insects into their diet. This aligns with the global narrative promoting insects as a "superfood" that is both nutrient-dense and eco-friendly. Conversely, the study confirmed that several psychological barriers significantly hinder acceptance. Food neophobia, a general aversion to unfamiliar foods, had a negative impact. More powerful deterrents were the feeling of disgust, a deeply ingrained emotional response, and risk perception, with consumers expressing concerns about the safety and hygiene of eating insects.

Perhaps the most striking and counterintuitive findings of the research were related to the roles of experience and familiarity. Contrary to much of the existing literature, which suggests that exposure typically increases acceptance, this study found that both factors had a significant negative effect on the participants' willingness to eat insects. The researchers posit that this result may be unique to the cultural context or the nature of the exposure. A negative first-hand experience—for instance, an unpleasant taste or texture—could create a lasting aversion that is more powerful than any theoretical benefits. Similarly, increased familiarity might not normalize insect consumption but instead reinforce negative perceptions by making consumers more aware of the insects' appearance or other culturally unappealing characteristics. This suggests that simply exposing consumers to edible insects is not enough; the quality of that experience is paramount.

From a theoretical standpoint, this research provides valuable contributions to the literature on consumer behavior and alternative proteins. It underscores that the acceptance of novel foods like insects is not merely a rational decision based on nutritional or environmental facts but is heavily mediated by deep-seated psychological and cultural factors. The strong negative influence of disgust and the unexpected negative impact of familiarity and experience highlight the necessity of culturally sensitive approaches when introducing such products. The study affirms that while pro-environmental and health-related motivations are powerful drivers, they may not be sufficient to overcome fundamental emotional barriers like disgust.

The study also offers several practical recommendations for businesses, marketers, and policymakers interested in promoting entomophagy (the practice of eating insects). To counteract the powerful disgust factor, the findings suggest that focusing on processed forms of insects, such as protein powders, flours, or bars, is a more viable strategy than presenting them in their whole form. This approach masks the insects' appearance and can make the product more palatable to hesitant consumers. Furthermore, marketing and communication efforts should be strategically targeted. Campaigns emphasizing the environmental sustainability and nutritional benefits of insect-based foods are likely to resonate with consumers who already possess high levels of environmental and health awareness. For the broader public, improving the sensory attributes (taste, texture, and smell) of insect-based produces is crucial to ensure that initial experiences are positive, thereby preventing the formation of lasting negative associations.

While the study provides a comprehensive analysis, the authors acknowledge its limitations. The data was collected from a specific sample group within Turkey, which may limit the generalizability of the findings to other

cultures or even different demographic groups within the country. Additionally, the research measured attitudes and intentions rather than actual consumption behavior, and there can often be a gap between what people say they will do and their real-life actions. Therefore, the study recommends several avenues for future research. Cross-cultural comparative studies could explore how these influencing factors vary across different societies. Experimental research involving sensory testing and taste trials could provide deeper insights into how to develop products that are appealing to consumers. Finally, investigating the role of media and social influence could help in crafting more effective communication strategies to normalize the concept of eating insects and foster wider acceptance of this sustainable food alternative.