

## The Effects of Healthy Nutrition Perception and Food Neophobia on Behavioral Intentions towards Edible Insect Products

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### Abstract

*When we visualize insects in our minds; an image appears about creatures that harm our food and drinks, cause economic and health problems, create negative senses like fear, disgust and shiver. According to many people, insects are living creatures which are needed to be eliminated. Yet, nature is not agreeing with those people. It is correct that insects cause many harmful effects but scientists state harmful insects are only %2-3 of a bigger insect's family which involves 1.500.000 species. These results show an only a minor portion of insects are harmful, and other ones either helpful or neutral. Insects are important creatures for balance of nutrition and energy connection. Besides being consumed as an important source of food, insects are also helpful for the food production which results in helping other creatures as well. In this study, it is thought that healthy food perception and food neophobia are effective for the consumption of products based on edible insects. In this respect, analyzes were made on gastronomic communities for these products. According to the results of the analysis, it was found that healthy nutrition perception had a significant and positive effect on neophobia. In addition, while neophobia attitudes of consumers had a significant and negative effect on behavioral intention towards edible insect consumption, it was observed that healthy nutrition attitude had no significant effect on behavioral intention towards edible insect consumption. In conclusion, it is seen that general health perception have a positive influence on food neophobia and food neophobia have negative effect on behavioral intentions.*

**Keywords:** Edible Insects, Neophobia, Healthy nourishment, Behavioral intentions

## Sağlıklı Beslenme Algısının ve Gıda Neofobisinin Yenilebilir Böcek Ürünlerine Yönelik Davranışsal Niyetlere Etkileri

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### Öz

Böcek denilince aklımıza; yiyecek ve içeceklerimize zarar veren, ekonomik kayıplara neden olan ve hastalıklara sebep olan, korku, tiksinti ve ürperti gibi olumsuz duygular gelmektedir. Böcekler birçok insana göre yok edilmesi gereken bir canlı olarak görülmektedir. Ancak tabiat bu kişilerle aynı fikirde değildir. Evet, böcekler birçok zararlı etkiye sahiptir. Fakat bilim adamları bu zararlı etkiye sahip böceklerin, 1.500.000 böcek türünün yalnızca %2-3'ünü oluşturduğunu belirtmektedir. Bu sonuçlar göstermektedir ki, böceklerin küçük bir kısmı zararlı olmakta geriye kalan kısmının ise, ya faydalı ya da nötr durumdadır. Böcekler, besin ve enerji iletişiminin dengesini sağlayan önemli yaratıklardır. Doğrudan besin olarak tüketilmesinin yanı sıra, besin üretimine yardımcı olarak diğer canlılara da faydalı olmaktadır. Bu çalışmada, yenilebilir böcek bazlı ürünlerin tüketilmemesinde gıda neofobisinin ve sağlıklı beslenme algısının etkili olduğu düşünülmüştür. Bu doğrultuda bu ürünlere yönelik gastronomi toplulukları üzerine analizler yapılmıştır. Analiz sonuçları doğrultusunda sağlıklı beslenme tutumunun neofobi üzerinde anlamlı ve pozitif bir etkisi olduğu ortaya çıkmıştır. Ayrıca tüketicilerin neofobi tutumlarının yenilebilir böcek tüketimine yönelik davranışsal niyetler üzerinde anlamlı ve negatif bir etkisinin olduğu tespit edilirken, sağlıklı beslenme tutumunun yenilebilir böcek tüketimine yönelik davranışsal niyetler üzerinde anlamlı bir etkisinin olmadığı görülmüştür. Çalışma sonunda, sağlıklı beslenmenin gıda neofobisi üzerinde ve gıda neofobisinin de davranışsal niyetler üzerinde etkisinin olduğu tespit edilmiştir.

**Anahtar Kelimeler:** Yenilebilir böcek, neofobi, sağlıklı beslenme

## Introduction

Today, in the face of increasing threats to global food security, insect consumption is shown as a solution for feeding humans and animals. In Europe and the USA (Van Huis et al., 2013). Insects with high nutritional and protein values are considered as an alternative to traditional animal meat consumption (Testa et al., 2016). In addition, low environmental requirements due to low soil requirements during production make insect consumption inevitable (Ooninx and De Boer, 2012). However, although insects are a sustainable alternative to traditional protein sources, they are regarded as harmful, repulsive and negative in many societies. Therefore, it is necessary to investigate the nutritional value of insects and their effects on human health (Shockley et al., 2013; Payne et al., 2016; Testa et al., 2016; Belluco et al., 2013; Finke et al., 2015). In addition, the process of increasing the awareness of consumers about insects should be continued continuously.

Factors affecting people's decisions about consuming or rejecting any animal based foods are emotional characteristics, culture, social environment, personal qualities and beliefs (Hartman et al., 2016; Martins et al., 2006; Sogari, 2015). Therefore, some animal and animal products are accepted as food in some countries' traditional delicatessens while others can be perceived as taboo (DeFoliart, 1999; Meyer-Rochow, 2009; Sogari et al., 2014). Especially in tropical and subtropical countries, there are 1900 insect species consumed by 2 billion people (Van Huis et al., 2013). Although many countries in Central America (Mexico), Asia (Japan, Thailand and China) and Africa are familiar with long-term past insect consumption, they have not been popular in Europe (Bodenhemers, 1951; Caparros Megido et al., 2014; Mlcek et al. 2014).

Insects harboring over one million known species and forming a large group of food chains; acts as environmental regulator in nature (soil cycle, decay and disintegration, spreading plants and fungi), bio indicator, nutrient / ecological footprint, serves as parasite (Ecevit, Akyazı and Akyazı, 2012; Makkar et al., 2014; Güneş and Sormaz, 2015). The relationship of such insects, which are abundant in nature, are used in various ways such as food, medicine, cosmetics, textile, music industry, agriculture, as animal

feed, biological control, organic waste-fertilizer, biomimetic, forensic medicine, biological weapons are (Saruhan and Tuncer, 2010).

In the world, due to population growth, the concern of reaching safe-enough food and decreasing protein source / producer are driven as an alternative food source, it has pioneered new trends such as edible foods, artificial meat and genetically modified foods, insect nutrition, developed with 3D technology (Van Huis, 2010).

Not just population growth; Factors such as reduced interest in agriculture and animal husbandry, migrations, unconscious nutrition, household waste and food waste also result in changes in nutritional and nutritional strategies. People have turned to various protein sources such as algae, algae, rapeseed, cultured meats and insects in order to achieve safe and sustainable diets while minimizing environmental impacts such as global warming (Becker, 2007; Van Huis, 2010; Post, 2012; Van Der Spiegel et al., 2013; Van Huis, 2015). Around two thousand insect species are being eaten in the world, especially in tropical regions (Van Huis, 2015). Feeding with insects has been an area of increasing interest since 2002. In 2006, the "insect eating" festival was held and in 2014 the conference in the Netherlands was attended by 45 countries and even in 2016 it was the subject of a documentary at the Edinburgh film festival. In gastronomic terms, there are many works written on insects since 1998 (Ramos-Aldorduy, 1998; Gordon, 2013; Lang, 2013; Grassi, 2014; Martin, 2014; Huis et al., 2016).

Increased interest in insects considered as food, supported by many potential benefits, is growing within an open and comprehensive legal framework at the international level. On this specific topic, in 2015, the European Commission ESFA prepared a report on the various risks-opportunities associated with the production and consumption of insects. ESFA stated in this report that there is no risk of insects being consumed as food and animal feed. However, ESFA emphasized that insects to be consumed as food should be grown and stored under appropriate conditions. In December 2015, the European Parliament and the Council adopted the new Regulation on Novel Food (2015/2283). This regulation is seen as a legal step that paves the way for the consumption of insects as food. According to the regulation, insects are entering a new definition of food in the European market, but they allow the introduction of insect-based products. This situation attracted great attention of the business world.

European countries such as England, Belgium and the Netherlands are preparing themselves to compete in this market. There are also many unanswered questions about the benefits and harms of insect consumption, risks and opportunities

## **Theoretical Framework**

Neophobia is the most cited factor in previous studies to explain consumer displeasure about insects as food (Hartman et al., 2015; Martins and Pilner, 2006; Ruby et al., 2015; Van Huis et al., 2013; Verbeke, 2015; Tramper et al. (2007).

Although neophobia is common in insects not being accepted as food, it differs in many particular ways. However, it does not provide a full explanation on this issue. Neophobia is a very strong emotion. Neophobia is described as a state of extreme fear waiting for feelings and innovations and developments aroused by something disgusting, hateful and despised.

There is a lack of research investigating the relationship between the factors that affect the insects' appearance as food. However, neophobia has been shown to be an important motivation to refuse to consume animal food such as insects (Pilner and Pelchat, 1991). Neophobia in consumers can make some people perceive some food sources as dangerous. Accordingly, the belief that people find new foods dangerous suggests that they negatively affect their desire to eat (Pilner et al., 1993). Therefore, it is possible to say that individuals with high levels of neophobia find it dangerous to eat insects and are less willing to eat insect-based foods. Therefore, in this study, it has been tested the FNS (Food Neophobia Scale) affects of intention to consume insect-based products.

Healthy nutrition; individuals growth, development, health protection and chronic illness to minimize the risk of long-term use of nutrients in the body to survive (Alpural, 2009, p.7). With scientific studies, it is concluded that there are more than 40 kinds of nutrients necessary for the survival of individuals. It was determined how much of these nutrients should be taken daily from each of these nutrients in order for individuals to survive in a healthy way. If these identified substances are not taken, it is scientifically proven that growth and development in individuals is impaired by

preventing growth and development because they are taken more or less than necessary (Çelik, 2004, p.15).

Healthy nutrition, the survival of individuals, to improve the quality of life and to maintain the health of the nutrients required by the body at the right time, adequate and balanced way into the body is required.

Studies show that healthy nutrition behaviors are effective in determining eating and drinking preferences. One of the factors affecting the consumption of edible insects of consumers is thought to be healthy nutrition attitudes. In this sense, it is possible to say that individuals who exhibit healthy nutrition behaviors find it unhealthy to eat insects and they are less willing to eat insect based foods. In this study, we aimed to investigate whether healthy nutrition attitudes (FHealth) affect the intention of consuming insect based products and affect food neophobia.

Zeithaml et al. (1996) defined behavioral intention as an indicator that individuals strengthen and maintain their relationship with a particular product. When individuals' evaluations against the product are low, their behavioral intentions are negative; the relationship is more likely to weaken. When the evaluations against the product are high, their behavioral intentions are positive; their relations with the product are strong (Zeithaml et al., 1996).

Swan et al. (1981) defined behavioral intention as the expected or planned future behavior of the individual. Warshaw and Davis (1985), on the other hand, define behavioral intention as a subjective possibility that an individual will perform his or her behaviors as expectations of people about their own behavior in a certain environment. This concept represents the individual's expectations about a particular behavior in a given environment and can be made functional as a possibility of acting. Consequently, behavioral intention can be defined as an indication of the possibility of continuity of individuals' relationship with consuming edible insect-based products. Measurement of behavioral intentions will be an important indicator for determining the future behavior of individuals in terms of edible insect consumption.

## Method

### *Sampling*

In this study, convenience sampling method was used and students who are active in Gastronomy clubs of universities constituted the universe of the study. There are gastronomy communities in 47 universities in Turkey in 2018. In this study, the gastronomy communities of 20 universities under the Tourism and Gastronomy Club were selected as a sample. The club organizes various gastronomic events every year. One of these activities has been on edible insects. The purpose of the activity is the status and future of foods made with edible insect-based products. students' eating-drinking, culture levels and nutritional patterns to be richer and the idea that students can learn about edible insects. Data were collected from 404 students by e-mail between February and June 2018.

46% of the participants were male and 54% were female students. 65% of the students are undergraduate and 5% are master students. 82% of the students are between the ages of 18-25. 6% of the students are older than 30 years.

### *Survey and Scaling*

Food neophobia was measured using ten substances. Peoples and Hobden expressions on the scale of food neophobia: 'I constantly try to taste new and different foods', 'I don't trust new and different foods', 'I don't know what is in it', 'I like foods from different countries', 'I like food from different countries' food seems strange to me ', 'I taste new and different foods at dinner events ', 'I'm afraid to eat food I've never tasted before ', 'I'm very picky about food ', 'I like to eat almost any food ', 'I like to go to ethnic restaurants. All expressions obtained from the food neophobia scale (Pillner and Hobden, 1992) were translated into Turkish. The expressions of some elements have been changed to better understand their participants. For example, the term 'ethnic food' is not used much in Turkish, which has been changed to 'dishes from other cultures'.

Consumers' attitudes toward the health characteristics of foods in general (Roininen, Lahteenmaki, and Tuorila (1999) were used to measure the

general health interest scale. These expressions were as follows: 'I prefer to be healthy', 'I prefer healthy foods', 'I give importance to my foods being low calorie', 'I always eat a balanced and healthy', 'I give importance to my daily foods contain too many vitamins and minerals', 'I give importance to the healthy snacks I consume during the day', 'I avoid to consume foods that increase cholesterol level', 'I eat things I like, regardless of their importance to health'. Each statement was examined as 5-point responses.

The scale developed by Balderjahn, Peyer and Paulssen (2013) was used to determine the behavioral intentions of the participants for edible insect consumption. Expressions included in the scale: 'I can probably buy edible insect products', 'I will buy edible insect products in my next purchase', 'I will definitely try edible insect products in the near future', 'I can go if there is a restaurant offering edible insect products', 'I recommend to consume insect products'. Participants' readiness to eat insect-based foods in their diet and their desires and attitudes to consume these products were examined. All items in the questionnaire measured on a five-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5).

### ***Data Analysis and Results***

Confirmatory factor analysis (CFA) is utilized to test the validity of scales and structural equation model (SEM) is used to test research hypotheses. Data related to the measurement model is shown in Table 1. Internal consistency is controlled with AVE, CR and Cronbach's alpha values. Then, convergent and divergent validities have been checked. AVE value should be higher than .50, CR and Cronbach's alpha values should be higher than .70 (Fornell and Larcker, 1981; Nunnally and Bernstein, 1994; Hair et al. 2010). For convergent validity AVE value should be higher than .50 and CR value should be higher than AVE value ( $CR > AVE$ ;  $AVE > 0,5$ ) (Hair et al. 2010). For divergent validity, AVE value of one dimension should be higher than the square of the highest correlation between dimensions and as seen in Table 2 this condition is provided (Fornell ve Larcker, 1981). Because all mentioned conditions are provided, the credibility and validity of formations used in the research model are ensured. When accord values are checked regarding CFA analysis, measurement model consisted of 3 factors and 16 substances is supported by data set.



**Table 1. Mean, Indicator loadings, critical ratios, Cronbach's alpha ( $\alpha$ ), Composite Reliability (CR) and AVE values.**

	Mean	$\beta$	T Values	$\alpha$	CR	AVE			
<b>Healthy nutrition (7 items)</b>	<b>3,28</b>			<b>.925</b>	<b>.933</b>	<b>.632</b>			
1-I prefer to be healthy	3,66	.627	fixed at 1						
2-I prefer healthy foods,	3,65	.667	21,744						
3-I give importance to my foods being low calorie	3,07	.819	13,544						
4- I always eat a balanced and healthy	3,08	.888	14,314						
5-I give importance to my daily foods contain too many vitamins and minerals	3,17	.867	14,069						
6-I give importance to the healthy snacks I consume during the day	3,27	.872	14,142						
7- I avoid to consume foods that increase cholesterol level	3,02	.784	13,120						
<b>Neophobia (4 items)</b>	<b>3,11</b>			<b>.823</b>	<b>.700</b>	<b>.543</b>			
1-I constantly try to taste new and different foods	2,89	.781	fixed at 1						
2-I don't trust new and different foods	3,38	.676	12,963						
3-I like foods from different countries	3,06	.800	15,162						
4- I'm afraid to eat food I've never tasted before	3,10	.684	13,132						
<b>Behavioral Intentions (5 items)</b>	<b>1,69</b>			<b>.971</b>	<b>.929</b>	<b>.870</b>			
1- I can probably buy edible insect products	1,66	.938	fixed at 1						
2-I don't trust new and different foods	1,65	.969	43,729						
3-I will definitely try edible insect products in the near future	1,72	.959	41,520						
4-I can go if there is a restaurant offering edible insect products	1,75	.918	34,655						
5-I recommend to consume insect products	1,63	.878	30,000						
$\chi^2$	df	SRMR	RMSEA	GFI	AGFI	NFI	IFI	TLI	CFI
Acceptable values		,050	,080	,900	,900	,900	,900	,900	,900
<b>Measurement Model</b>	<b>192,559</b>	<b>100</b>	<b>,037</b>	<b>,048</b>	<b>,943</b>	<b>,923</b>	<b>,967</b>	<b>,984</b>	<b>,981</b>

Acceptable values for fit indexes by Hair et al. (2010) and Awang (2012).

In order to test research hypotheses structural model is tested. Model consistency is a very good level for SEM. Results of the structural model test are shown in Table 2 and Figure 1.

**Table 2. The result of correlation analysis**

Component	Inter-factor correlation		
	HE	NEO	BI
HE	<b>,292</b>		
NEO	<b>,541</b>	<b>,292</b>	
BI	<b>-,135</b>	<b>-,271</b>	<b>,073</b>

As a result of the research, it appeared that healthy nourishment attitude has a positive and significant effect on neophobia ( $\beta_1=.541$ ,  $p<.001$ ). This result supports the H<sub>1</sub> hypothesis. It appeared that neophobia attitude of consumers has a negative and significant effect on behavioral intentions regarding insect consumption ( $\beta_2=-.280$ ,  $p<.001$ ). This result supported the H<sub>2</sub> hypothesis. It appeared that healthy nourishment attitude has not a significant effect on behavioral intentions regarding insect consumption ( $\beta_3=.016$ ,  $p<.001$ ). Yet, healthy nourishment attitude has a secondary effect on behavioral intentions regarding insect consumption at a level of  $\beta_{3ind}=.151$ . This result didn't support H<sub>3</sub> hypothesis.

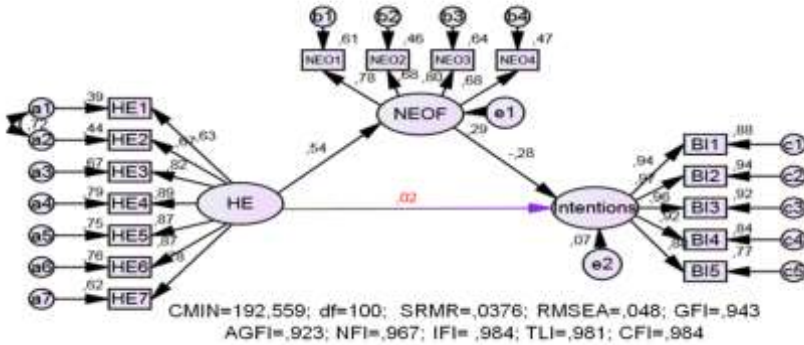


Table 3. Path model results

Paths	R <sup>2</sup>	$\beta$	SE	t-Values	p	Assessment
NEOF ← HE	,292	,541	,059	9,274	***	Supported
Intentions ← NEOF		-,280	,069	-4,088	***	Supported
Intentions ← HE	,074	,016	,065	,255	,799	Not supported

\*\*\*p < .001 SE: Standard Error

Differences between the evaluation of food and smell signals are detected for neophobic people in studies made by Raudenbush and friends. A device which measures smelling behavior and the Food Neophobia Scale is used in studies. Differences are found regarding the rating of food and smell signals (Raudenbush vd., 1998).

While Pliner and Hobden (1992) state no differences for a hedonic rating of known or new food for neophobic, Tuorila vd. (1994) shows that rating of

visual, taste and smell are different. An important tendency appears in the evaluation of data. Neophobics rarely shows differences regarding decisions about known signals.

Pliner and Hobden (1992) use the Food Neophobia Scale on the matter of young adults' food neophobia to compare international Lebanese and American students' food neophobia levels. It is spotted that Lebanese students have higher levels of neophobia for new foods. It is stated that reasons for higher neophobia are current way of nourishment and lack of desire for consuming new foods due to cultural differences.

## Discussions

The aim of this study is to investigate the effect of food neophobia and healthy nutrition behaviors on behavioral intention in consuming insect based products. In this sense, neophobia and healthy nutrition behavior were determined as the main variable. Two of the three hypotheses developed were supported by the findings of the study. The findings obtained from this research have shown that food neophobia is an important factor in determining the intention to consume insect-based foods. In the light of these findings, it can be said that food neophobia may be useful for understanding attitudes towards edible insect products in the consumer context. On the other hand, it is understood that the factors affecting the development of food neophobia can be explained by the variable of healthy nutrition behaviors. In a sense, this study also demonstrates that two variables, food neophobia and healthy nutrition behavior, can be used to explain their intention to consume edible insect based products.

The findings of this study may also help public and private sector managers to explain how important edible insect-based foods are to humanity and provide a reference framework for developing practices on edible insect consumption. In fact, it can be said that healthy nutrition behavior added to the research model does not directly affect the intention of edible insect consumption. However, it can be understood that healthy nutrition behavior is an important variable in the investigation of the factors that cause food neophobia and that it can help activities in this direction. Developing a reliable system for the existence of edible insects in the world and the importance of human beings in healthy nutrition and providing education on listening to

the fears of the society in this direction and suggesting solutions are the main things that can be done in this sense. If the community believes that procedures for edible insects are reliable, healthy, and can communicate with food producers without problems, levels of neophobia against edible insect consumption will also decrease. Nevertheless, activities such as the preparation of food and the availability of edible insect-based products for centuries have been explained by explaining the situation of human nutrition and the preparation and serving of such meals, which can be easily accessible, but may also affect the perceptions of healthy nutrition. In addition, positive perceptions of insect-based foods can lead to consumption of these products. Continuation of this process may increase the search for edible insects. At the end of the study, it should be understood that edible insects are not harmful to human nature and the existence of such foods is important for a sustainable life. In order to continue this understanding, it is necessary to investigate the food neophobia that occurs for edible insect based products and the health nutrition behaviors that cause this phobia.

### **Future Research**

In this study, convenience sampling method was used and a limited number of participants could be reached from the gastronomy communities of the universities. In addition, the students who are educated at the undergraduate level are represented to a greater extent in the sample. For these reasons, the generalization of the findings obtained in this study will not be correct. However, in future studies, models related to food neophobia, healthy nutrition and behavioral intentions can be developed for the consumption of edible insect based products on larger samples by using the scales used in this study. In addition, other variables can be added to these models. In this study, behavioral intention regarding the consumption of edible insects was accepted as an indicator of food neophobia and healthy nutrition behaviors towards behavioral intentions were not observed. This made testing the relationship between intention and healthy nutrition behavior impossible. On the other hand, healthy nutrition behavior can mediate between food neophobia and behavioral intention. However, a different research method is needed in the analysis of such relationships. In future research, scenario management can be used to examine the relationship

between intention to eat edible insects and food neophobia and the variables that play a role in this relationship. In this study, socio-demographic variables were associated with edible insect consumption in the literature, although it was not included in the analyzes as a variable affecting the intention of edible insect consumption. However, the findings of previous studies on this subject are not consistent. In this study, the effect of neophobia and healthy nutrition on the understanding of edible insect consumption has been measured in a small number of studies in foreign literature and has not yet been found in the national literature. Although healthy nutrition behavior could be included in more studies among these variables, neither the national nor foreign literature examined all of the variables discussed in this study together.

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