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Does the acceptance of insects as food depend on sociodemographic characteristics: The case of Serbia

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Abstract: Animal-based food has historically been considered dietary staples because it offers many essential nutrients. Due to their high nutrient content, edible insects have the potential to partially replace animal-based food as healthy and sustainable alternatives. The aim of this research is to determine if sociodemographic characteristics of respondents play important role in acceptance or rejection of insects as food. The results showed that male respondents have favourable attitudes towards acceptance, motivation and general attitude compared to female respondents. In terms of age, it was determined that older people are more likely to accept insects. Results also showed that highly educated people express a higher level of acceptance of insects, while the effects of income level are not significant. As Serbia is not a country where insects have been traditionally consumed, it is not expected that consumption will become widespread in foreseeable future.

Keywords: insects, food, acceptance, sociodemographic characteristics, Serbia
JEL classification: L66

Da li prihvatanje insekata u ishrani zavisi od sociodemografskih karakteristika: Studija slučaja Srbija

Sažetak: Hrana životinjskog porekla se kroz istoriju smatrala osnovom svake ishrane jer pruža mnoge neophodne nutrijente. Zbog svoje velike nutritivne vrednosti, jestivi insekti imaju potencijal da delimično zamene namirnice životinjskog porekla i nameću se kao zdrava i održiva alternativa. Cilj ovog istraživanja je da odredi da li sociodemografske karakteristike ispitanika imaju važnu ulogu u prihvatanju ili odbijanju insekata u ishrani. Rezultati su pokazali da muškarci imaju veću motivaciju, pozitivniji odnos i viši stepen prihvatanja insekata u ishrani od žena. Što se starosti tiče, stariji ispitanici su dali pozitivnije ocene. Ispitanici koji imaju viši stepen obrazovanja su pokazali viši nivo prihvatanja, dok mesečna primanja nisu bila značajan faktor. S obzirom na to da Srbija nije država u kojoj su insekti tradiconalno korišćeni u ishrani, u doglednoj budućnosti se ne očekuje da dođe do promene.

Ključne reči: insekti, hrana, prihvatanje, socio-demografske karakteristike, Srbija
JEL klasifikacija: L66

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1. Introduction

Today, humanity is facing population growth which means we will need more food (UN, 2020). The standard of living is rising in most countries regardless of their development (Roser, 2016).That brings an increase in the consumption of meat and other animal products (Bruinsma, 2003; FAO, 2017). Global warming is also a big issue and many authors (e.g. Monteny et al., 2001; Vaghar Seyedin et al.., 2022) believe that animal husbandry is an important factor in greenhouse gas emissions. That is why there is a strong pressure to reduce the use of animal products (Eshel et al., 2014; Hedenus et al., 2014), despite the fact that there are 957 million hungry people on the Earth (UN, 2020). The custom of eating insects is called entomophagy. It has been a habit since the ancient times and is even mentioned in the Bible. The production of insects has many benefits. The most important ones are less land (Van Huis et al., 2013), water and energy needed (Miglietta et al., 2015; Oonincx & de Boer, 2012), lower greenhouse gas and ammonia emission (Oonincx et al. 2010; Van Huis et al., 2013) and the possibility to use waste products of agriculture and food industry as feed (Collavo et al., 2005; Oonincx et al., 2015; Sorjonen et al., 2019; Van Broekhoven et al., 2015). Besides these benefits, edible insects are also nutritionally valuable. They have high protein content, polyunsaturated fat, energy, vitamins and micronutrients (EFSA, 2021a; EFSA, 2021b; EFSA, 2021c; EFSA, 2021d; EFSA, 2022; Janssen et al., 2017).

Insect consumption as food and feed has received a lot of attention recently from academics and the public, particularly in Western nations. There is plenty of research on the topic of consumer approval of insects as food in some countries in Europe and worldwide (Giotis & Drichoutis, 2020; Hartman et al., 2015; Laureati, 2016; Liu et al, 2020; Naranjo-Guevara et al., 2020; Schäufele et al., 2019; Szendro et al., 2020; Verneau, 2016). In most European countries insects are considered disgusting, dangerous, dirty and consumption of insects is usually associated with "primitive" people's eating habits (Van Huis et al., 2013). Studies discovered that consumers in Nordic countries are more open to consuming insects in relation to those in Hungary, Poland and Italy (Kostecka et al., 2017; Piha et al., 2018; Sogari, 2015; Szendrő et al., 2020).

So far, there have been no scientific articles issued the approval of edible insects by Serbian consumers. This study aims to evaluate knowledge, rejection, acceptance, and motivation of consuming insects as type of food among Serbian consumers. The organization of the paper is as follows. The description of relationship between sociodemographic characteristics and motivation and rejection is provided in the section on literature review. The selection of the hypotheses was justified by citing the literature that are presented in the literature review section. The following parts of the paper present the research methods, the outcomes of testing the hypotheses, and the discussion of the findings. The results section of this paper contained the interpretation of the results, while the conclusion, theoretical and practical implications, the study's limits, and suggestions for future research and model expansions were saved for the final section.

2. Literature review

Studies respecting consumer approval of insects as food are numerous (e.g. Gmuer et al., 2016; Hartman & Siegrist, 2016; Tan et al., 2016). In many studies it was found that sociodemographic characteristics such as gender, age or education level affect consumers' readiness to consume insects as a food.

2.1. Gender

Men are more positive about entomophagy than women (Barsics et al., 2017; Menozzi et al., 2017; Schösler et al., 2012; Szendrö et al., 2020; Tan et al., 2016). According to Vartiainen et al. (2020), women, students, people under 25 years old, those who live in rural areas displayed a lower inclination to eat food derived from insects. Consumers with higher knowledge of insects as food have a higher acceptance rate for their use in the human diet. Neophobia is an important factor when it comes to rejection. Only slight increase in neophobia drastically increases rejection. Woman are less inclined to accept insects probably due to higher neophobia (Hartmann et al., 2015). Cicatiello et al. (2016) found that males were more inclined to try insects. On the other hand, many studies (e.g. de Boer et al., 2013; Hartmann et al., 2015) did not discover a notable relationship between gender and the acceptance of insect-based food products. Similarly, Bakkaloglu (2022) and Mancini et al. (2019) did not find significant impact of gender on readiness to try insects.

2.2. Age

Orsi et al. (2019) found that younger people have more favorable attitudes regarding entomophagy. Detilleux et al. (2021) emphasize in their research that male respondents are more willing to consume insects than female respondents even though this study was aimed at Belgian children (9-17). Also, younger children were more open towards whole insects than older kids. Younger people are considered to be more open towards edible insects so that is why they were chosen for this study. Knowledge about insects increases scores given for a taste test. This could indicate that higher level of knowledge could increase the overall acceptance of insects in human diet (Megido et al., 2016). In addition to this, they found positive significant influence of age on tendency to eat edible insects. On the contrary, several studies (e,g. Cicatiello et al., 2016; Rumpold & Langer, 2019; Schäufele et al., 2019; Woolf et al., 2019) did not found substantial influence of age on willingness to try insects.

2.3. Education level

There are not many studies examining how education level affects consumer approval of insect food. According to Cicatiello et al. (2016), consumers with higher levels of education were more likely to be open to eating insects as food. Anankware et al. (2017) discovered favorable associations between eating insects and education. To explain this, they noted that reople with higher education tend to travel and be more receptive to novel experiences. Additionally, people with higher levels of education might be more conscious of the nutritional advantages of edible insects and consume them more frequently as a result (Liu et al., 2020). According to Mancini et al. (2019), it appears that young men with high levels of education are typically the most likely early adopters. On the other hand, Lammers et al. (2019) found no discernible impact of education on approval of insects as food. According to research by Pambo et al. (2018), intention to eat food created from edible insects solidified over time relative to their less educated counterparts. Surprisingly, Brunner and Nuttavuthisit (2019) discovered that the influence of education varied between cultures, with early adopters of eating insects in Switzerland being better educated than those in Thailand.

2.4. Income level

When it comes to income, different results were obtained. Carolyne (2018) and Manditsera et al. (2018) found a unfavorable link between income level and edible insect consumption. Manditsera et al. (2018) in their research in urban areas found negative relationship between income level and consumption of insects. According to them, as incomes rise, consumers

have more choice for different animal proteins. Egan (2013) found that those with lower incomes eat more edible insects, probably because they spend less money on food when insects are widely available. In their study, Liu et al. (2020) found that age, income level and household size positively influence their intention to buy insects. In other words, consumers are more expected to purchase edible insects when they are older, have a higher level of income and a larger family size. Contrary to this, Bakkaloglu (2022) did not prove noteworthy effect of income on the readiness to try insects.

Based on this, the authors propose the following hypotheses:

H_1: Men have a higher level of acceptance of insects as food.
H_2: Younger people have a higher level of acceptance of insects as food.
H_3: Highly educated people have a higher level of acceptance of insects as food.
H_4: People with lower level of income have a higher level of acceptance of insects as food.

3. Methodology

The aim of this paper is to determine knowledge, rejection, acceptance and motivation among Serbian consumers. The research was conducted during summer of 2022. Target group was adult citizens of Serbia. The survey was conducted online and it was on a voluntary basis and anonymous. The basis for this research was found in research conducted by Szendrö et al. (2020). All factors and items used in the research used as a base were completely adopted and translated into Serbian. Questionnaire used in the research consisted of two parts. Questions about sociodemographic characteristics of respondents (such as gender, age, education level, level of income, place of residence) made up the first part of the questionnaire. Second part of the questionnaire consisted of 5 factors with items related to the consumption of insects as food. The first factor, *Knowledge* consisted of five items related to respondents' knowledge about insects as food (e.g. *"Insects are often consumed in some parts of Africa, Asia and South America")*. Second factor, *Rejection* is described through one item (e.g. *"Food containing edible insects disgusts me").* The third factor, *Acceptance,* consisted of five items related to the approval of insects and insect products (e.g. *"I think insects would be prepared in a good way in restaurants"*). Fourth factor, *Motivation* is described through three items related to motivation for consuming insects (e.g. *"If I learned that a close person is consuming insects, I would try it too").* The last factor, *Attitude,* contained items related to general attitudes towards insects as food (e.g. *"I think food containing insects is tasty"*). Respondents were asked to assess the degree of their agreement with provided statements on 5-point Likert scale (1 – completely disagree, 5 – completely agree). A total of 502 questionnaires were completed, but 443 were valid (response rate 88.3%).

4. Results and discussion

Table 1 presents the information about socio-demographic characteristics of respondents. There are 302 females (68.2%) and 141 males (31.8%). Regarding the age of respondents, they were divided into four age groups: *18-29* (49.2%), *30-39* (12.4%), *40-49* (12.4%) and *Over 50* (26.0%). Most respondents are highly educated (34.3%), followed by those who completed high school (32.7%). The smallest number of respondents has a PhD degree (12.2%). When it comes to place of residence, most of the respondents live in big cities (73.1%), followed by those who live in small cities (16.3%). The smallest number of respondents lives in villages (10.6%). Regarding income level, the most of respondents have incomes higher than the republic average (32.7%).

Table 1: Sociodemographic characteristics of respondents

Sociodemographic characteristics	Frequency	Percent
Gender		
Male	141	31.8
Female	302	68.2
Age		
18-29	218	49.2
30-39	55	12.4
40-49	55	12.4
Over 50	115	26.0
Level of education		
High school	145	32.7
College/Faculty	152	34.3
Master's Degree	92	20.8
PhD	54	12.2
Place of residence		
Village	47	10.6
Small city (<100.000 inhabitants)	72	16.3
Big city (>100.000 inhabitants)	324	73.1
Income		
No income	116	26.2
Under the republic average (< RSD 81.359)	**70**	**15.8**
Republic average (RSD 81.359)	112	25.3
Above the republic average (> RSD 81.359)	145	32.7

Source: Authors' research

Table 2 shows the results of a descriptive statistical analysis of items related to consumption of edible insects. Within this table, the distribution by grades is shown, as well as the arithmetic mean and standard deviation for each statement. Generally, the highest score was given to the statement *"Insects are often consumed in some parts of Africa, Asia and South America"* (4.25) within factor 1 (Knowledge), which led to the conclusion that the respondents are well-informed about the parts of the world in which insects are considered regular food. On the other hand, the lowest score was registered for the item *"I think insects are food only for "primitive" people"* (1.70). Factor *Rejection* has a relatively high score (3.59), which is not surprising due to the fact that insects are not traditionally consumed in Serbia. Low scores for *Acceptance* (2.57), *Motivation* (2.54) and *Attitude* (2.73) only support the high scores obtained for item related to rejection of insects as food in Serbia.

Table 2: Descriptive statistical analysis

FACTORS AND ITEMS	Answers (grade)					Mean	Std deviation
	1	2	3	4	5		
KNOWLEDGE (M=3.304)							
Insects are often consumed in some parts of Africa, Asia and South America.	16	12	62	107	246	4.25	1.033
In some European countries, food containing edible insects is available.	21	36	124	118	144	3.74	1.137
I think insects can be served to "civilized" people.	50	26	102	88	177	3.71	1.342
I think insects are food only for "primitive" people.	287	53	71	13	19	1.70	1.106
A silk bug drink can be nutritious.	49	21	253	66	54	3.12	1.055
REJECTION (M=3.59)							
Food containing edible insects disgusts me.	48	53	94	85	163	3.59	1.368
ACCEPTANCE (M=2.57)							
I think insects would be prepared in a good way in restaurants.	70	38	129	130	76	3.23	1.283
I would try products that have processed insects (e.g. cookies).	166	50	70	85	72	2.65	1.530
I would try whole fried insects (e.g. mealworms, grasshoppers, crickets).	224	58	43	60	58	2.26	1.504
I would use flour made from insects to prepare food at home.	204	54	83	56	46	2.29	1.417
I would try products that do not emphasize it on the package but they are listed in declaration.	190	50	80	79	44	2.41	1.434
MOTIVATION (M=2.54)							
If I learned that a close person is consuming insects, I would try it too.	136	59	90	72	86	2.80	1.506
As a guest at someone's home I would not reject food containing insects.	153	59	81	74	76	2.69	1.508
I would try edible insects in another country.	200	78	94	48	23	2.13	1.245
ATITUDE (M=2.73)							
I think insects are exotic food.	80	25	89	118	131	3.44	1.428
I would like to try food containing insects.	182	47	81	66	67	2.52	1.511
I am interested in food which contains insects.	189	56	83	54	61	2.42	1.474
I think food containing insects is tasty.	127	46	200	41	29	2.55	1.184

Source: Authors' research

Table 3 shows that there is no statistically notable difference between males and females when it comes to knowledge but it is shown that females have a higher level of rejection of food containing insects and males have a higher level of acceptance and motivation and generally more positive point of view towards using insects as food. This is because women are more neophobic than man, which was proven by multiple research papers (Chang et al., 2019; De Boer et al., 2013; Hartmann et al., 2015; Schösler et al., 2012; Verbeke, 2015;). Although males have a higher chance of having a positive attitude towards insects as food, it should be noted that grades obtained by male respondents are still low. These findings are somewhat similar to the results shown by Szendrö et al. (2020) and provide support for H_1.

Table 3: T-test for gender

Factor	Gender		T-value	Sig (p)
	Male	Female		
Knowledge	3.80	3.84	-0.574	0.567
Rejection	3.38	3.69	-2.255	0.025
Acceptance depending on the way of preparation and shape	2.84	2.44	3.113	0.002
Motivation	2.78	2.43	3.030	0.003
Attitude	2.91	2.65	2.274	0.024

Source: Authors' research

From Table 4, it is evident that age is an important factor when it comes to the acceptance of respondents. The respondents from the youngest age group (18-29) showed the lowest approval of edible insects. Their approval of edible insects is statistically significantly lower in comparison to respondents from age groups 30-39 and over 50. The oldest group (over 50 years of age) showed the highest acceptance. That is somewhat surprising as in most studies (e.g. Megido et al., 2016; Schösler et al., 2012; Verbeke, 2015) younger people were more willing to try edible insects. Although obtained results did not provide support for H_2, they are likewise prior studies' results (e.g. Liu et al., 2020).

Table 4: One-way Anova test for age

Factor	Age				F value	p	LSD post-hoc test
	18-29	30-39	40-49	>50			
Knowledge	3.86	3.85	3.69	3.81	0.783	0.504	-
Rejection	3.71	3.45	3.67	3.39	1.631	0.181	-
Acceptance depending on way of preparation and shape	2.42	2.80	2.32	2.85	4.571	0.004	1<2.4 4>1.3
Motivation	2.44	2.66	2.40	2.75	2.368	0.070	-
Attitude	2.62	2.87	2.62	2.93	2.237	0.083	-

Source: Authors' research

Table 5 shows that education is an important factor when it comes to acceptance, motivation and attitude. It is evident that the respondents with higher education gave higher scores when it comes to items within these three factors. LSD post-hoc test showed that the respondents with higher education degree (PhD) have a higher level of acceptance of insects than those with lower education degree. These results confirmed H_3 and they are in accordance with the findings got by Laureati et al. (2016) and Szendrö et al. (2020).

Table 5: One-way Anova test for education

Factor	Education				F value	p	LSD post-hoc test
	Elementary and high school	Faculty/ college	Master's degree	PhD			
Knowledge	3.82	3.77	3.90	3.88	0.633	0.594	-
Rejection	3.61	3.73	3.50	3.30	1.515	0.210	-
Acceptance depending on way of preparation and shape	2.44	2.45	2.73	2.99	3.832	0.010	4>1.2
Motivation	2.32	2.51	2.72	2.91	4.380	0.005	4>1.2
Attitude	2.57	2.64	2.97	3.01	3.730	0.011	4>1.2

Source: Authors' research

Table 6 presents that there is no notable distinction between respondents with different incomes. These results match with results obtained in Bakkaloğlu (2022) and Szendrö et al. (2020) studies and reject H_4.

Table 6: One-way Anova test for income

Factor	Income				F value	p	LSD post-hoc test
	No income	Under the national average	National average	Above national average			
Knowledge	3.83	3.83	3.76	3.87	0.513	0.674	-
Rejection	3.71	3.80	3.52	3.46	1.409	0.239	-
Acceptance depending on way of preparation and shape	2.43	2.53	2.54	2.72	1.260	0.288	-
Motivation	2.42	2.48	2.52	2.68	1.244	0.293	-
Attitude	2.54	2.79	2.68	2.90	2.352	0.072	-

Source: Authors' research

5. Conclusion

The future of entomophagy and, generally, the production and eating of peculiar food proteins depend on the ability to identify the aspects that might influence consumers' perceptions of edible insects. Nevertheless, when people associate insects with human food, they have two very different mental responses. In cultures where eating insects as food is traditional or popular, people view them as a vital source of food that has been passed down through the years. On the other side, according to studies by Dobermann et al. (2017) and Sogari and Vantomme (2014), insects in Western cultures can evoke powerful negative psychological reactions.

The aim of this paper was to enable understanding of socio-demographic variables that might influence customers' perceptions of edible insects. This could be crucial for the future of entomophagy and more generally, for the production and consumption of peculiar food proteins. Since in Serbia there is no custom of consuming insects, there are no programs to

promote consumption. The findings of this research uncovered that men are more likely to eat insects than women, which confirms H_1. These results are in accordance with prior studies (e.g. Barsics et al., 2017; Menozzi et al., 2017; Tan et al., 2016). Many studies confirmed that younger people have more favorable attitudes towards entomophagy (e.g. Detilleux et al., 2021; Orsi et al., 2019). Contrary to authors' expectations, the findings of this study revealed that older people are more likely to accept insects as food. These results did not prove H_2, but they are in line with prior studies' results (e.g. Liu et al., 2020). Considering this, the proposal made by Tranter (2013) should be applied. He proposed that children should be the primary target of many projects which are made to facilitate the spread of insect-based food. The basis for this proposal lies in the fact that children are the next generation of customers and they can influence perceptions of their peers. It was shown that education level plays a notable role in the approval of insects as food. The results showed that people with higher level of education (PhD) have a higher level of acceptance of insects in contrast to those with lower level of education. These results confirmed H_3 and they are in line with the results obtained by Laureati et al. (2016) and Szendrö et al. (2020). Although there were a lot of different results when it comes to income level, in this study the authors failed to find any notable influence of income level on approval of insects as food. Even though these results did not provide support for H_4, the obtained results are in the line with results obtained by Bakkaloğlu (2022) and Szendrö et al. (2020). The results of this research can help in profiling people who are willing to consume insects. In the sample from Serbia, these would be men, of an older age and with a higher level of education.

In many studies, psychological factors such as neophobia, have been examined as a significant factor for comprehending consumer approval (Hartman et al., 2015; La Barbera et al., 2018). Neophobia significantly reduces person's willingness to consume insects, according to the scientific evidence (Piha et al., 2018; Tan et al., 2016; Vartiainen et al., 2020). For this reason, future research should include psychological factors, in order to understand better the mechanism of acceptance of insects as food. Also, acceptance or rejection of novel foods, such as insects, is mostly influenced by emotional and cultural beliefs rather than product-related characteristics (price, taste, etc.) (Hartmann & Siegrist, 2016; Meixner & Mörl von Pfalzen, 2018). Since this study did not consider these before mentioned factors, it could be included in future research. In previous studies (e.g. Sogari et al., 2019), consumers' prior exposure to insects has a positive impact on their expectations of sensory attributes (taste and appearance), which raises their willingness to try them.

Conflict of interest

Authors have no conflict of interest.

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