

CONSUMER ATTITUDES TO FOOD PRODUCTS MADE FROM EDIBLE INSECTS

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Summary. The number of people in the world is constantly increasing, which makes a search for alternative food sources necessary. A questionnaire survey was conducted on a nationwide sample of 310 Poles. This study aimed to assess consumers' attitudes to food products made with edible insects as a whole and/or their particular ingredients. After analysing the results obtained, it can be concluded that the knowledge about edible insects and the possibility of consuming them is still insufficient. Moreover, one of the obstacles to the consumption of this type of product is the psychological barrier and the awareness of the origin of insects. Nevertheless, the surveyed population had a high preference for products containing insects as one of the ingredients or in which only insect protein was added. This would allow for the development of new food products with a high chance of market success, bearing in mind the appropriate degree of processing the insects and the form of the manufactured product.

Key words: edible insects, entomophagy, novel food, consumer's acceptance, questionnaire survey research

INTRODUCTION

The world's population is constantly increasing, and it is estimated that 30 years or so from now there could be 9 or even 11 billion people [Zielińska et al. 2015, Varelas and Langton 2017]. Feeding such a large number of people will require an increase in food production by up to 60%, which will not have a positive impact on the surrounding environment, let alone agree with the idea of sustainable development [Varelas and Langton

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2017]. To prevent this, the possibility of using edible insects as an alternative food source has attracted increasing interest in recent years. This is primarily due to their interesting chemical composition: high content of complete protein and rich in polyunsaturated fatty acids, as well as numerous minerals, vitamins, and fibre [Zielińska et al. 2015, Zielińska et al. 2018, Cicatiello et al. 2020].

In recent years, changes in dietary trends have been observed among consumers, and they are increasingly looking for food products characterized by functional properties that can positively affect their health [Jeżewska-Zychowicz 2014]. Therefore, an interesting phenomenon and/or trend has recently been observed involving added insect flour to some products, e.g., cereals, meats, as well as to bakery and confectionery products. The addition of insects in this form goes a long way in overcoming the fear and reluctance of consumers associated with the consumption of such products [Castro and Chambers 2019, Mancini et al. 2019]. It is estimated that, in the future, insect protein will not only be used as an alternative to protein preparations popularly used in the meat industry [Smetana et al. 2016, Anuduang et al. 2020] but also in special dietary use products, such as products for athletes [Meyer and Reguant-Closa 2017, Lynch et al. 2018]. Therefore, this study aimed to determine consumer attitudes towards food products made with edible insects as a whole and/or their components.

MATERIALS AND METHODS

The questionnaire survey was conducted in August 2020 on a nationwide sample of 310 people, defined in terms of sex, age, education, place of residence, and size of household. The detailed characteristics of the respondents are presented in Table 1.

In the study, the CAWI (Computer Assisted Web Interview) method was used, which consists of interviews performed via the Internet with a questionnaire to be filled in by respondents. The self-administered questionnaire consisting of 12 single- or multiple-choice questions covered the following issues: consumption of edible insects and products made with some insect-based ingredient, willingness and intention to consume them in the future, benefits, and risks of their consumption, environmental and ethical conditions of breeding edible insects for food purposes, as well as the acceptance of such products in trade.

Statistical analysis

Statistical analysis was performed using the Statistica 13.1 program (StatSoft Inc., Tulsa, USA). Due to the qualitative type of the answers, the χ^2 test of independence was used to ascertain the significance of differences between the variables, verifying the following hypotheses: sex, age, and education of the respondents influence the willingness to consume edible insects and products with insects as an ingredient or high-protein only, awareness of the environmental impact of the farming of edible insects compared to traditional livestock, and perception of the use of edible insects for food production as ethical. The analysis was performed with the selected constant parameters presented in Table 1. The analysis was performed at a significance level of $\alpha = 0.05$.

Table 1. Sociodemographic profile of the group of respondents surveyed

Tabela 1. Charakterystyka socjodemograficzna badanej grupy respondentów

Characteristic of the surveyed population	Percentage [%]
Sex/Płeć:	
woman/kobieta	76.8
man/mężczyzna	23.2
Age [years]/Wiek [lata]	
18–25	67.4
26–40	25.8
41–60	6.1
60 and over/60 i więcej	0.7
Education/Wykształcenie	
primary/podstawowe	0.3
secondary/średnie	27.4
vocational/zawodowe	1.3
higher/wyższe	71.0
Place of residence/Miejsce zamieszkania	
village/wieś	22.6
city/miasto <50 000 inhabitants/mieszkańców	13.9
city/miasto 50 000–150 000 inhabitants/mieszkańców	11.3
city/miasto 150 000–500 000 inhabitants/mieszkańców	6.4
city/miasto >500 000 inhabitants/mieszkańców	45.8
Size of household/Wielkość gospodarstwa domowego	
1-person/1-osobowe	19.7
2–3-person/2–3-osobowe	48.4
4–5-person/4–5-osobowe	25.8
above 5-person/powżej 5 osób	6.1

RESULTS AND DISCUSSION

The consumers' attitudes to specific food products are varied; therefore, the questionnaire survey conducted within this study aimed to obtain information about consumers' preferences regarding the consumption of edible insects as a whole and the products containing insects as one of the ingredients. A significant majority (84%) of the respondents declared that they had never eaten such products, while a little more than half (51%) stated that they would be willing to taste edible insects as a whole after preparing (processing) them. Among Italian, Danish [Verneau et al. 2020] and Hungarian consumers [Gere et al. 2017], the highest acceptance towards insect-based foods was shown by food consumers who are looking for both new products but also new ways to prepare it, seek information about products and intend to reduce meat consumption. The respondents' education or age had no significant impact on the willingness to consume edible insects as a whole and

after processing. However, gender was a crucial factor for the willingness to consume insects as a whole after processing. The statistical analysis led to the conclusion that men declared a greater willingness to consume edible insects as a whole than women. The research conducted by Verbeke [2015] on the Belgian population indicates that the target group for such products is younger men who are open to trying new foods and are thus interested in the environmental impact of their food choices. Similar findings were obtained from a study conducted by Laureati et al. [2016], who found that willingness to consume insects was higher among men than women living in Italy. These results also line up with those obtained by Schlup and Brunner [2018]. Similarly, among the Switzerland population young men were more willing to try insects and the authors explained this by the fact that this group may be more familiar with this type of food.

As for the methods of processing edible insects before consumption, frying, and roasting were the most often indicated responses (Fig. 1). This choice may be since some of the respondents may have encountered such products before. In many parts of the world, edible insects are available as the so-called street food – after being fried and/or roasted. They are also becoming more popular and available for example in on-line stores. It may also be assumed that this choice was related to Poles' general preference for these methods of cooking [Korzeniowska-Ginter 2009]. When it comes to the cooking of meat, it was also found in the questionnaire survey conducted among students that over 70% of them prefer frying and merely 18% opt for roasting [Orkusz and Janczar-Smuga 2016].

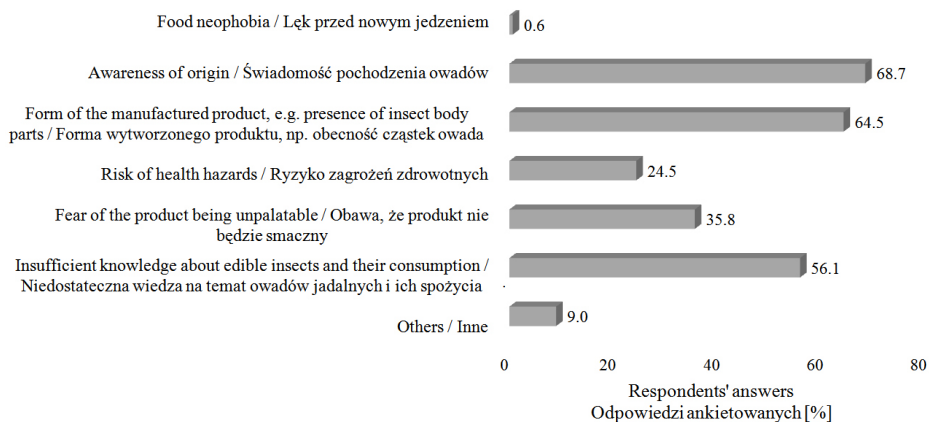


Fig. 1. Preferred methods of processing edible insects before their consumption by respondents

Rys. 1. Preferowane metody przetwarzania owadów jadalnych przed ich spożyciem przez respondentów

Consumers' behaviour in the food market and their purchasing decisions depend on both the products on offer and their subjective preferences. Therefore, the next set of questions concerned the respondents' interest in consuming products that contain edible insects as one of the ingredients or as only highly purified insect protein. The research showed that nearly 70% of the respondents wanted to taste the products with added insects as one of the ingredients, while a little below 80% with added protein only. After the statistical analysis, it was concluded that neither gender, age nor education impacted

the responses to the question concerning the willingness to consume products containing edible insects as one of the ingredients or the question concerning the products containing added insect protein. It is worth emphasizing that grinding insects to powder was also one of the preferred methods of processing edible insects before their consumption (Fig. 1). The latter is confirmed in numerous papers. For instance, Mancini et al. [2019] proved that recently an increasing tendency has been observed in the European countries to consume insects added in the form of flour or powder to the composition of some traditional well-known and widely popular products such as bakery products, pasta, burgers, sausages, meatballs, candy bars or salty snacks. Also, Hartmann et al. [2015] highlighted the significance of insect-based foods in limiting negative consumer attitudes towards this type of food.

Consumers are becoming more and more aware of the relationship between their eating habits, life span, and quality of life. As many as 73% of the respondents admitted that edible insects could be part of a balanced diet. A well-balanced human diet involves providing all necessary nutrients so that the body's need for them is satisfied. It concerns mainly protein since its primary function is to build the cells of the living organism. To meet the body's need for protein, food producers search for new sources, while trying to rationally use the existing ones and taking into account environmental aspects [van Huis et al. 2013, Amarender et al. 2020]. Edible insects seem to be a promising source, as they contain protein in an amount similar to that of other breeding animals [Lynch et al. 2018]. What is more, the content of amino acids is comparable or even higher than that of beef [van Huis et al. 2013, Sun-Waterhouse et al. 2016]. Therefore, insect powder may soon become a component of full-value liquid or solid food products, which are eaten after exercise as regenerative meals, e.g., by people practicing sports [Meyer and Reguant-Closa 2017].

As for the reasons which cause reluctance and limit the consumption of food made with edible insects, the most important ones (indicated by 60% of the respondents) were the awareness of the origin and the form of the product such as the presence of edible insect body parts in the cross-section of the product (Fig. 2). Insects are widely perceived as pests that can cause numerous dangers [Cicatiello et al. 2020]. This conviction significantly impacts the willingness to consume them. As for the latter reason, many consumers pay attention to the form of the product. That is why consuming insects as a whole is perceived as abominable and revolting (disgusting), while consuming them in a different form definitely evokes much less negative emotions [Mancini et al. 2019, Cicatiello et al. 2020]. This revulsion (disgust) may originate from the cultural and social background on one hand, and the insufficient knowledge of the subject on the other hand. Moreover, in the emotional perspective, it may protect from the potential threat to life and/or health [Szeja 2019]. Our study shows that insufficient knowledge of the consumption of edible insects is one of the most important factors responsible for the reluctance to consume products containing edible insects (Fig. 2). Similarly, the research conducted by Mancini et al. [2019] proved that a conducted seminar on the issues in entomophagy contributed to a decreased reluctance and rejection of bakery products with added insect flour. As well, Laureati et al. [2016] found that providing information about the environmental factors associated with insect production had a positive effect on the level of acceptance of such products. A slightly different view was provided by Sogari et al. [2019], who suggested

that providing information on the environmental and nutritional benefits of consuming insects will not affect consumer acceptance of the products. Our survey results confirm this as nearly 70% of the respondents indicated that the increased access to the information about edible insects and their possible consumption would persuade them to eat such products. However, as the research by Castro and Chambers [2019] proves, the insect body parts visible in the cross-section of the product are still not acceptable for consumers. This clearly points to the need for further research into edible insects and their possible processing, but also for informing the general public of the recent findings on this topic. It is crucial for building consumers' awareness and decreasing their reluctance to consume such products.

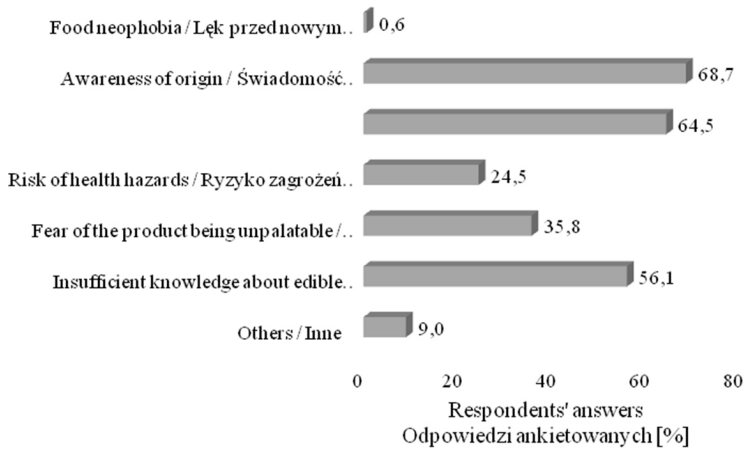


Fig. 2. Reasons limiting the respondents' consumption of edible insects

Rys. 2. Powody stanowiące ograniczenie chęci spożywania owadów jadalnych przez respondentów

The next part of the research concerned the benefits and risks of eating edible insects and products containing them as one of the ingredients. A significant portion of the respondents (41%) was aware of the large and rather large benefits of edible insects consumption for themselves and the environment (Fig. 3). However, it is worth mentioning that the opinions of the remaining respondents (59%) may point to the need for providing more and more information to the general public, or consumers, who might be interested in such consumption (Fig. 2).

The other aspects of the research concerned the environment and the ethical approach to the breeding of edible insects for consumption. What is interesting, despite the previously declared insufficient knowledge of edible insects, approximately 90% of the respondents pointed to the beneficial impact of breeding edible insects on the environment in comparison with traditional animal breeding. This may result from the fact that it is one of the most commonly used arguments for using edible insects as an alternative source of food [Wendin et al. 2019, Cicatiello et al. 2020]. After conducting a statistical analysis, it may be concluded that education, especially higher levels, impacted the responses

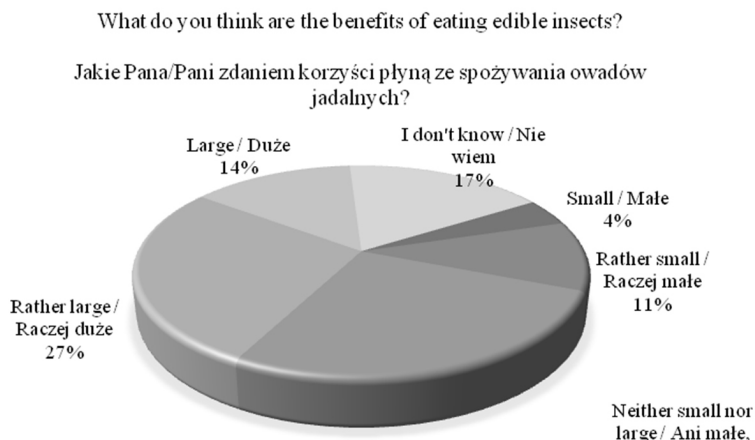


Fig. 3. The respondents' opinions about the benefits of eating edible insects

Rys. 3. Opinie respondentów dotyczące korzyści wynikających ze spożywania owadów jadalnych

greatly, while other demographic features examined (gender and age) had no impact on the perception of the benefits of breeding edible insects for the environment in comparison with the traditional animal breeding.

Due to the interesting chemical composition of insects and their less harmful impact on the environment, edible insects may become the food of the future and/or novel food. However, this was difficult to admit for every fourth respondent (Fig. 4), while 60% agreed that it was an important direction for food production in the future. It may be connected with their environmental awareness, as well as the awareness of sustainable food production principles and the need to relieve animal suffering. The above indicates the possibility of taking actions aimed at designing new food products, including those with added edible insects and/or their parts, with a high potential for market success.

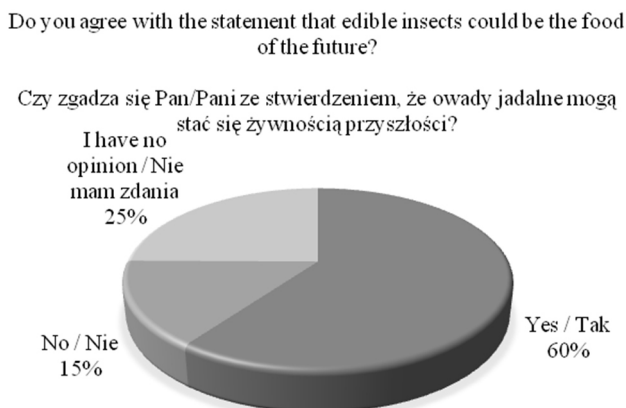


Fig. 4. The respondents' willingness to regard edible insects as the food of the future

Rys. 4. Skłonność respondentów do postrzegania owadów jadalnych jako żywności przyszłości

When it comes to food production, ethical dilemmas are also extremely important, especially concerning animal products. More than half of the respondents declared that using edible insects in food production is ethical (Fig. 5). The respondents' gender and age in this case had a significant impact on the responses. It was men that mostly perceived using edible insects in food production as ethical as opposed to women. As for education, it was observed that the higher the education, the greater the number of respondents who perceived using insects as ethical. Summing up, when it comes to the possibility of using insects in food production, most of the respondents did not object to such practice nor did they have ethical dilemmas in this respect. There are two reasons for such an attitude. Firstly, having relatively little knowledge on this subject and no previous reflections and deliberations in this regard, the respondents did not feel competent to take a stance on this issue condemning the practice of using insects in food production. Secondly, assuming that some of the respondents had specific and well-established knowledge in the field of broadly understood bioethics and accepted the culinary practices with the use of insects, it can be said with high probability that they supported the common view in the Polish culture that all species of animals living on earth, including insects, play a service role towards humans. Therefore, to meet the basic human needs, i.e. the need to satisfy hunger and to ensure a well-balanced diet, insects can be used for food production, provided that they are not inflicted with unnecessary pain and suffering [Ślipko 2012, Olszak 2018].

The opponents of using insects for consumption, such as vegetarians and vegans, support the view that humans and other living creatures do not differ significantly in the way they react to external stimuli. Such an attitude of some of the respondents results from the

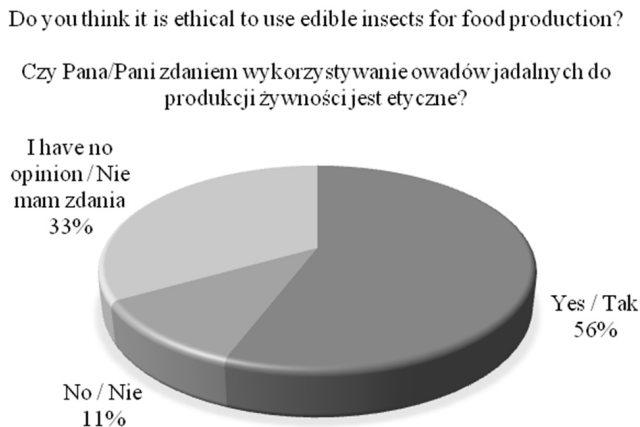


Fig. 5. The respondents' opinions about the perception of using edible insects for food production

Rys. 5. Opinie respondentów dotyczące postrzegania wykorzystywania owadów jadalnych do produkcji żywności jest etyczne

interest in oriental religions (especially Indian ones), mostly found in young people, or from the adoption of the naturalistic world view of the elderly [Grzesica 1983].

Those who had no opinion on using insects for food production had probably limited knowledge of the issue and did not want to take a stand on the issue. Their attitude to moral dilemmas of bioethical nature was passive. They accepted culinary traditions in which they were raised, but they did not object to novel foods or products with various compositions if they corresponded to their tastes and satisfied their hedonistic appetites [Francuz 2018].

CONCLUSIONS

Since farming of edible insects has less impact on the environment, what was pointed by approximately 90% of the respondents, and their use for food purposes is one of the likely solutions in the search for alternative food sources, conducted questionnaire survey seems to be fully justified. Moreover, the dissemination of up-to-date findings and continuous communication and transfer of knowledge to consumers could be a good strategy to reduce the reluctance to consume products based on edible insects, since 59% respondents was not aware of the large and rather large benefits of edible insects consumption for themselves and the environment. Already at this stage, it was observed that a high percentage of respondents were characterized by the willingness to consume products containing insects as one of the ingredients (nearly 70% of the respondents) or those containing only insect protein (a little below 80% of the respondents). This indicates the need for further research into the methods of edible insects processing to include them in the composition of various food products.

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BADANIE POSTAW KONSUMENTÓW WOBEC PRODUKTÓW SPOŻYWCZYCH WYTWORZONYCH Z OWADÓW JADALNYCH

Streszczenie. Liczba ludzi na świecie nieustannie wzrasta, co powoduje poszukiwanie alternatywnych źródeł żywności. Przeprowadzono badanie ankietowe na ogólnopolskiej próbie liczącej 310 Polaków. Celem tego badania było określenie postaw konsumentów wobec produktów spożywczych wytworzonych z wykorzystaniem owadów jadalnych w całości i/lub poszczególnych ich składników. Na podstawie uzyskanych wyników badań stwierdzono, że wciąż brak jest dostatecznej wiedzy na temat owadów jadalnych oraz możliwości ich spożycia. Ponadto, jedną z przeszkód spożywania tego typu produktów jest bariera psychologiczna oraz świadomość pochodzenia owadów. Mimo to badana populacja charakteryzowała się wysoką chęcią do spożycia produktów zawierających owady jako jeden ze składników bądź takich, w których dodane zostanie wyłącznie białko owadzie. Pozwala to na opracowywanie nowych produktów spożywczych z dużą szansą na ich sukces rynkowy, pamiętając o odpowiednim stopniu przetworzenia owadów oraz formie wytworzonego produktu.

Słowa kluczowe: owady jadalne, entomofagia, nowa żywność, akceptacja konsumentka, ankieta konsumentka

