

**LEVEL OF CONCERN FOR THE ENVIRONMENT,
FOOD SECURITY AND ENVIRONMENTAL SUSTAINABILITY
ABOUT TO WILLINGNESS TO EAT FOOD CONTAINING INSECTS:
A SURVEY AMONG THE GENERATION Z IN POLAND**

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Purpose: This study aimed to determine whether the lifestyles of young consumers (students) in Poland can influence their attitudes towards foods containing edible insects.

Design/methodology/approach: The empirical survey was conducted via an online platform (CAWI) among 749 students in Poland in 2023.

Findings: Most lifestyle determinants (commitment to learning, attention to the nutritional value of food, valuing the culinary traditions of the region of origin, health consciousness and physical activity) correlated positively with environmental concern in terms of willingness to eat food containing edible insects.

Research limitations/implications: The research has certain limitations. Despite the large size of the study group, the results obtained are not representative and cannot be generalised to the Z population in Poland.

Practical implications: The results of this study may prove beneficial in the development of strategies to enhance food security, particularly in the context of environmental protection.

Social implications: The study contributes to the existing body of knowledge regarding the attitudes of young adults, commonly referred to as Generation Z, towards environmental care, food security concerns, and environmental sustainability. In doing so, it considers the influence of lifestyle variables.

Originality/value: An investigation into the influence of younger consumers' lifestyles on their attitudes towards environmental care, food security concerns and environmental sustainability is of significant importance in the context of the future of entomophagy in Poland.

Keywords: Insect-based foods, edible insects, young consumers, environmental concern, food security concerns, environmental sustainability concerns.

Category of the paper: Research paper.

1. Introduction

In light of the expanding global population and the limitation of agricultural land, it is imperative to identify alternative means of protein source production. One of the primary contributors to anthropogenic climate change is livestock production. Conventional agricultural practices can exert a detrimental impact on production, natural resources and ecosystem services, particularly in the context of a changing climate. To address this, a more sustainable diet would need to be introduced, incorporating less meat consumption or using alternative protein sources. Edible insects can play an important role in the global food system due to several benefits, of which the environmental and nutritional ones are highlighted as the greatest (van Huis, Oonincx, 2017). Due to their nutritional (Rumpold, Schlüter, 2013), economic and environmental potential (Dobermann, Swift, Field, 2017; van Huis, Oonincx, 2017), insects could become the main global food of the future (Lange, Nakamura, 2021; Megido et al., 2018; Sun-Waterhouse et al., 2016; van Huis, 2013). It can be confidently stated that edible insects can be discussed in the context of food security, understood as ensuring that people have access to adequate food quality and quantity. It can be confidently asserted that edible insects can be discussed in the context of food security. This is defined as ensuring that people have access to adequate food quality and quantity (FAO, 2021). Insects are regarded as a valuable source of proteins, fats, vitamins and minerals. Insects contain essential amino acids, including methionine, cysteine, lysine, and threonine (Kowalski et al., 2022; Zielińska, Baraniak, Karaś, 2018). The chemical composition of edible insects demonstrates that both insects themselves and products made from them can contribute to improving the nutritional status of humans and, in a wider perspective, help to deal with malnutrition (Cheseto et al., 2015; Gumul et al., 2023; Kouřimská, Adámková, 2016; Nino et al., 2021a, 2021b; Ochieng et al., 2022; Pal, Roy, 2014; Rumpold, Schlüter, 2013; Sun, 2008; Ying et al., 2001). It is assumed that edible insects can successfully become part of a strategy to achieve global food security (van Huis, 2015; Lange, 2021) especially in the context of more sustainable and environmentally friendly production of nutrient-rich food than animal production (Dobermann, Swift, Field, 2017; Halloran et al., 2018; van Huis et al., 2017). According to Costa-Neto (2020), insects are medicinal resources for humans in many cultures around the world because they contain a variety of biologically active compounds, e.g. peptides (Hall, Reddivari, Liceaga, 2020; Zielińska, Baraniak, Karaś, 2018), polysaccharides (Malm, Liceaga, 2021; Mohan et al., 2020) and phenolic compounds (Nino et al., 2021, Baigts-Allende et al., 2021), which have many health-promoting or protective properties, namely antioxidant, antihypertensive, anti-inflammatory, antimicrobial or immunomodulatory. The therapeutic potential of insects also includes analgesic, antimicrobial, diuretic, anaesthetic and antirheumatic properties (Costa-Neto, 2020). In this sense, insects can be considered a source of nutrients for the human body, as well as a potential source of compounds that can be transformed into ingredients for functional foods or nutraceuticals (Guiné et al., 2023).

Despite the many benefits of entomophagy, consumer acceptance remains a major barrier to promoting edible insect-based foods among European populations. While insects are widely consumed in many regions of the world, their consumption in European countries is associated with neophobia and disgust (Hartmann, Siegrist, 2017; Vane-Wright, 1991). The disgust associated with eating and accepting or rejecting insect consumption is rooted in culturally determined eating habits (Mignon, 2002; Mela, 1999), and plays a major role in people's rejection of specific foods (Fessler et al., 2003). It is therefore important to identify the factors that would influence the acceptance of edible insects as a regular part of the diet of the European population. A survey of young adults in Poland (Generation Z) revealed a willingness to engage in a range of activities related to changing eating habits to improve their own and their families' nutritional status (Platta et al., 2023a, 2023b).

This study aimed to determine whether the lifestyle of young consumers in Poland (Generation Z) can influence their level of concern for the environment, food security and environmental sustainability, in terms of their willingness to consume food containing edible insects.

The following research hypotheses were formulated:

H1: Lifestyle variables influence the attitudes of a selected group of Generation Z consumers towards environmental concerns in terms of their willingness to consume foods containing edible insects.

H2: Lifestyle variables influence the attitudes of a selected group of Generation Z consumers towards food security and environmental sustainability in terms of their willingness to consume food containing edible insects.

2. Research methodology

2.1. Subjects

An empirical study was conducted among 749 students at three Polish universities: Gdynia Maritime University, the Academy of Applied Sciences in Nowy Sącz and the University of Warmia and Mazury in Olsztyn. The survey was conducted using a specially designed questionnaire, via a web-based platform (CAWI, Computer Assisted Web Interview) in 2023. All respondents gave their free, informed consent to participate in the survey and were assured of anonymity. The participants in the study were those who declared that they ate all foods and did not limit their consumption of meat or animal products.

In the sample, 55.01% of respondents were female, while 44.99% were male. A positive attitude towards environmental care was declared by 35.91% of respondents, an ambivalent one by 29.24% and a negative one by 34.85%. A positive attitude towards food security and

environmental sustainability was declared by 32.58% of respondents, an ambivalent one by 43.39% and a negative one by 24.03% (Table 1)

Table 1.
Characteristics of the respondents

Variables	Number of persons	% of indications
Gender		
Men	337	44.99
Women	412	55.01
Attitudes towards environmental concerns		
Negative	261	34.85
Ambivalent	219	29.24
Positive	269	35.91
Attitudes towards food security and environmental sustainability		
Negative	180	24.03
Ambivalent	325	43.39
Positive	244	32.58

Source: own elaboration based on survey results.

2.2. Questionnaire and data analysis

This article uses the results of an empirical study conducted using a standardised survey questionnaire. In preparing the questionnaire, a set of statements adapted from other authors' studies/papers was used. The instrument contained 17 items, measured based on a five-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = no opinion, 4 = agree, and 5 = strongly agree) (Likert, 1932). The questionnaire was validated by assessing the construct validity and estimating the reliability of the scales used using Cronbach's alpha coefficient. The α value obtained was 0.92, indicating good reliability.

The details of the items in each dimension are given below:

- Items in dimension one – Lifestyle Determinants (8 items): I am a person committed to work (1); I am a person committed to learning (2); I am a person pleasure oriented (3); I am a person who values convenience and speed of food preparation (4); I am a person who pays attention to the consumption of food with high nutritional value (5); I am a person who values the culinary traditions of the origin region (6); I am a person with high health consciousness (7); I am a person with high physical activity (8). The first, fifth, sixth, and seventh items were adapted from Arvola et al. (2007) and the others (2, 3, 4, 8) were additional.
- Items in dimension two – Environmental Concern (EC) (3 items): 1. When I buy food, I try to pay attention to how its production affects the environment (EC1); 2. I try to avoid food products whose production is harmful to the environment (EC2); 3. I am interested in how food production impacts the environment (EC3) (Verbeke, 2015; Roberts, 1996; Modlinska et al., 2021).

- Items in dimension three - Concern for Food Security (FSC) (4 items) and Concern for Environmental Sustainability (ESC) (2 items) resulting from the willingness to consume foods containing edible insects in their composition: Implementing the practice of consuming foods containing edible insects in their composition (fresh, frozen, dried, powdered e.g. meal) can solve problems such as: 1. hunger and malnutrition (FSC1); 2. ensuring access to nutritious foods (FSC2); 3. high demand for protein sources (FSC3); 4. ensuring access to foods high in n-3 fatty acids (FSC4); 5. sustainability in food production (ESC5); 6. reducing greenhouse gas emissions (ESC6). The second, third and fifth items were adapted from the Lim et al. study (2022), the fourth and sixth from the Guiné et al. study (2023), and the first was additional.

The empirical material was presented in the form of a percentage distribution of the answers given regarding attitudes and lifestyle determinants. The answers were aggregated and presented for three groups: The responses were categorised as follows: „no” (the number of „definitely no” and „rather no” responses were aggregated); „don't know/don't have an opinion” and „yes” (the number of „definitely yes” and „rather yes” responses were aggregated). A Chi-square test with Yates correction was conducted to determine the relationship between environmental concern and food security and environmental sustainability resulting from respondents' willingness to eat foods containing edible insects and lifestyle determinants. Spearman's rank correlation analysis was used to establish the relationship between environmental concern and food security, as well as environmental sustainability and lifestyle determinants.

Two multinomial ordered logit models were constructed. In the first model, the dependent variable is a variable examining environmental concerns. The explanatory variable was calculated based on the variables: 1.1. When I buy food, I try to pay attention to how its production affects the environment; 1.2. I try to avoid food products whose production is harmful to the environment; 1.3. I am interested in how food production impacts the environment. The independent variables are lifestyle determinants: I am a person committed to work; I am a person committed to learning; I am a person pleasure oriented; I am a person who values convenience and speed of food preparation; I am a person who pays attention to food of high nutritional value; I am a person who values the culinary traditions of the region I come from; I am a person of high health consciousness; I am a person of high physical activity. The target variable is ordinal (categories: negative, ambivalent, positive).

In the second model, the dependent variable is a variable examining concern for food security and environmental sustainability. The explanatory variable was calculated based on the variables: „In your opinion, can the practice of consuming food containing edible insects (fresh, frozen, dried, powdered e.g. meal) solve problems such as hunger and malnutrition; ensuring access to food with high nutritional value (food security); high demand for protein sources; ensuring access to food with high concentrations of n-3 fatty acids; sustainability; reducing greenhouse gas emissions”. The independent variables are lifestyle determinants:

I am a person committed to work; I am a person committed learning; I am a person pleasure oriented; I am a person who values convenience and speed of food preparation; I am a person who pays attention to food of high nutritional value; I am a person who values the culinary traditions of the region I come from; I am a person of high health consciousness; I am a person of high physical activity. The target variable is ordinal (categories: negative, ambivalent, positive).

A significance level of $p < 0.05$ was assumed for all statistical analyses. Calculations were performed using Excel 2000 and Statistica 13.3 (Tibco Software, Palo Alto, USA).

3. Results and discussion

In light of the existing literature, it is notable that respondents exhibit a complex ambivalent attitude towards health and environmental concerns, particularly about their willingness to consume edible insects (Mikulec et al., 2024). In a world where individuals are constantly exposed to information, the experience of ambivalence has become an intrinsic part of human existence (van Harreveld, Nohlen, Schneider, 2015). It is defined as the coexistence of positive and negative associations within a single attitude (Jonas, Broemer, Diehl, 2020). Ambivalent attitudes appear to be a common phenomenon, with the capacity to persist over extended periods. Furthermore, their association with behaviour has been extensively researched. At the individual level, ambivalence has been found to increase response latency when a choice has to be made, prolong information processing, affect attitude stability and may even lead to discomfort. It is similarly worthwhile to consider whether ambivalence results in greater resistance or an increased susceptibility to persuasion and influence. It seems that ambivalent attitudes are flexible and, depending on the context, can either help individuals to adapt better or prevent them from reaching satisfactory conclusions (Rothman et al., 2017; van Harreveld, Nohlen, Schneider, 2015).

The analysis of the relationship between lifestyle and concern for the environment and food security and environmental sustainability revealed significant differences only for selected lifestyle determinants, as indicated by responses to the statements on the scale (Tables 2-9).

The results indicated that there was no significant impact of involvement or lack of involvement in professional work on environmental concerns and food security and environmental sustainability as a result of respondents' willingness to consume foods containing edible insects in their composition (Table 2).

Respondents' commitment to learning correlated significantly and positively with their concerns for the environment. Thus, those who were more committed to learning showed greater concern for the environment, as indicated by respondents' willingness to eat food containing edible insects. All groups differed significantly in the frequency of responses to

statements on the environmental concern scale, although „no” was the predominant response in all groups. In the group not committed to learning, these responses ranged from 59.65% to 71.93%. On the other hand, for statements such as „I try to avoid food whose production is harmful to the environment” and „I am interested in how food production affects the environment”, there was an increase in the percentage of responses confirming that these were important issues for the respondents, especially in the group committed to learning (Table 3).

Self-perception through the lens of pleasure orientation did not significantly influence or correlate with concern for the environment and food security and environmental sustainability as a result of respondents' willingness to eat food containing edible insects in its composition (Table 4).

Table 2

Concern for the environment, food security and environmental sustainability and commitment to work

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	58.91	16.83	24.26	50.00	27.00	23.00	51.23	20.58	28.19	Chi2=6.35; df=4; p=0.17	0.07
EC2	46.04	22.77	31.19	36.00	32.00	32.00	42.95	23.94	33.11	Chi2=4.18; df=4; p=0.38	0.03
EC3	39.60	26.24	34.16	34.00	32.00	34.00	40.04	21.92	38.04	Chi2=5.16; df=4; p=0.27	0.03
Food security concerns (FSC)											
FSC1	29.21	26.73	44.06	35.00	33.00	32.00	33.11	24.16	42.73	Chi2=6.13; df=4; p=0.19	0.01
FSC2	27.72	26.24	46.04	30.00	30.00	40.00	26.62	25.95	47.43	Chi2=1.86; df=4; p=0.76	0.02
FSC3	22.77	20.79	56.44	23.00	27.00	50.00	25.95	27.74	46.31	Chi2=6.32; df=4; p=0.18	-0.06
FSC4	27.23	33.17	39.60	23.00	48.00	29.00	28.64	37.58	33.78	Chi2=7.17; df=4; p=0.13	-0.03
Environmental sustainability concerns (ESC)											
ESC1	29.21	29.70	41.09	24.00	47.00	29.00	30.87	37.81	31.32	Chi2=7.58; df=4; p=0.18	-0.06
ESC2	26.73	31.19	42.08	26.00	34.00	40.00	29.75	35.35	34.90	Chi2=3.48; df=4; p=0.48	-0.08

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

For selected statements included in the food security concern scale, significant differences were observed in the frequency of 'yes' responses. When confronted with statements describing how foods containing edible insects in their composition can ensure access to foods of high nutritional value and meet a high demand for a source of protein, those who valued convenience and speed of food preparation were significantly more likely to have a positive attitude (47.38 and 51.08% respectively) compared to the other groups (Table 5).

Table 3.

Concern for the environment, food security and environmental sustainability and commitment to learning

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	71.93	10.53	17.54	57.50	22.50	20.00	51.23	21.16	27.60	Chi2=10.54; df=4; p=0.03	0.13
EC2	64.91	10.53	24.56	52.50	20.00	27.50	40.34	26.22	33.44	Chi2=15.99; df=4; p<0.01	0.12
EC3	59.65	22.81	17.54	45.00	30.00	25.00	36.96	24.23	38.81	Chi2=16.47; df=4; p<0.01	0.20
Food security concerns (FSC)											
FSC1	36.84	26.32	36.84	40.00	22.50	37.50	31.44	26.23	42.33	Chi2=1.97; df=4; p=0.74	0.06
FSC2	29.82	28.07	42.11	32.50	25.00	42.50	26.84	26.53	46.63	Chi2=0.99; df=4; p=0.91	0.05
FSC3	28.07	22.81	49.12	22.50	40.00	37.50	24.54	25.15	50.31	Chi2=4.68; df=4; p=0.32	0.02
FSC4	29.82	31.58	38.60	25.00	42.50	32.50	27.45	38.04	34.51	Chi2=1.36; df=4; p=0.85	0.01
Environmental sustainability concerns (ESC)											
ESC1	35.09	35.09	29.82	27.50	42.50	30.00	29.14	36.66	34.20	Chi2=1.52; df=4; p=0.82	0.05
ESC2	31.58	29.82	38.60	37.50	47.50	25.00	28.22	33.59	38.19	Chi2=4.45; df=4; p=0.35	0.03

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

Table 4.

Concern for the environment, food security and environmental sustainability and pleasure orientated

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	62.00	12.00	26.00	53.26	21.74	25.00	52.39	20.92	26.69	Chi2=3.05; df=4; p=0.55	0.01
EC2	56.00	20.00	24.00	45.65	25.00	29.35	41.35	25.04	33.61	Chi2=4.58; df=4; p=0.33	0.06
EC3	50.00	26.00	24.00	45.65	17.39	36.96	37.23	25.37	37.40	Chi2=7.82; df=4; p=0.10	0.07
Food security concerns (FSC)											
FSC1	40.00	18.00	42.00	30.43	29.35	40.22	31.96	26.19	41.85	Chi2=2.80; df=4; p=0.59	0.02
FSC2	36.00	28.00	36.00	22.83	33.70	43.47	27.35	25.37	47.28	Chi2=5.48; df=4; p=0.24	0.04
FSC3	28.00	24.00	48.00	19.57	36.96	43.47	25.21	24.22	50.57	Chi2=6.77; df=4; p=0.15	0.02
FSC4	38.00	30.00	32.00	22.83	45.65	31.52	27.35	37.23	35.42	Chi2=5.37; df=4; p=0.25	0.02
Environmental sustainability concerns (ESC)											
ESC1	44.00	30.00	26.00	25.00	42.39	32.61	29.00	36.57	34.43	Chi2=6.32; df=4; p=0.18	0.02
ESC2	50.00	26.00	24.00	25.00	42.39	32.61	27.18	33.44	39.98	Chi2=8.20; df=4; p<0.11	0.06

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude

Source: own elaboration based on survey results.

It was observed that those who were unable to indicate whether convenience and speed of food preparation were important considerations when making food choices, and those for whom this lifestyle factor was not a significant factor, were significantly more likely to present negative attitudes towards concern for environmental sustainability resulting from the

respondents' willingness to eat food containing edible insects. Conversely, respondents for whom this lifestyle factor was important were more likely to present ambivalent and positive attitudes towards concern for environmental sustainability. This was evidenced by a positive significant Spearman's rank correlation coefficient (Table 5). As indicated by Modlinska et al. (2021), while educating the public about the sustainable properties of insect-based foods and targeting marketing strategies to this characteristic may be beneficial, it is not a sufficient strategy to convince consumers to purchase and consume insects. A study conducted among students in Italy revealed that communication with potential young consumers is crucial for achieving this goal (Mancini et al., 2019). One effective method of encouraging individuals to try insect-based foods for the first time is to organise informative tasting sessions.

Table 5.

Concern for the environment, food security and environmental sustainability and a commitment to convenience and speed of food preparation

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	64.00	8.00	28.00	54.90	23.53	21.57	52.16	21.14	26.70	Chi2=7.06; df=4; p=0.13	0.03
EC2	58.00	14.00	28.00	39.22	33.33	27.45	41.98	24.85	33.17	Chi2=7.67; df=4; p=0.10	0.02
EC3	44.00	24.00	32.00	33.32	33.34	33.34	39.2	23.77	37.03	Chi2=2.84; df=4; p=0.58	0.01
Food security concerns (FSC)											
FSC1	46.00	20.00	34.00	35.30	27.45	37.25	31.02	26.39	42.59	Chi2=4.99; df=4; p=0.29	0.06
FSC2	48.00	14.00	38.00	31.37	31.37	37.26	25.46	27.16	47.38	Chi2=13.51; df=4; p=0.01	0.12
FSC3	38.00	18.00	44.00	29.42	35.29	35.29	23.30	25.62	51.08	Chi2=9.90; df=4; p=0.04	0.09
FSC4	40.00	28.00	32.00	29.41	43.14	27.45	26.39	38.12	35.49	Chi2=5.69; df=4; p=0.22	0.06
Environmental sustainability concerns (ESC)											
ESC1	42.00	30.00	28.00	41.18	37.25	21.57	27.62	37.35	35.03	Chi2=9.35; df=4; p=0.05	0.08
ESC2	42.00	24.00	34.00	37.25	41.18	21.57	26.70	34.26	39.04	Chi2=11.82; df=4; p=0.02	0.10

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

Respondents' attention to the high nutritional value of food was a factor associated with concern for the environment, food security and environmental sustainability, resulting from respondents' willingness to consume food containing edible insects. Those who did not and could not specify whether they paid attention to the high nutritional value of food were significantly more likely, compared to the other groups, to have a negative attitude towards the individual statements on the scale. Respondents showed negative attitudes towards the following statements: „When I buy food, I try to pay attention to how its production affects the environment" - as high as 83.82% of respondents; „I try to avoid food products whose production is harmful to the environment" - 70.59% of respondents; „I am interested in how food production affects the environment" - 66.18% of respondents. A positive, significant, weak correlation was also observed between concern for health and attention to the high

nutritional value of food (Table 6). That edible insects could provide a potential solution to global hunger and malnutrition was indicated significantly more often by those who declared that they do not pay attention (40.45%) and that they pay attention (45.43%) to the high nutritional value of food. For statements describing that food containing edible insects can provide high demand for protein sources and contribute to reducing greenhouse gas emissions, a significant positive correlation was observed (Table 6).

Table 6.

Concern for the environment, food security and environmental sustainability and attention to food with high nutritional value

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	83.82	7.36	8.82	64.12	24.43	11.45	41.49	23.03	35.48	Chi2=103.37; df=4; p<0.01	0.37
EC2	70.59	12.50	16.91	48.85	32.82	18.33	33.40	25.93	40.67	Chi2=76.94; df=4; p<0.01	0.30
EC3	66.18	19.85	13.97	46.56	33.59	19.85	29.46	23.24	47.30	Chi2=91.73; df=4; p<0.01	0.37
Food security concerns (FSC)											
FSC1	35.29	24.26	40.45	38.93	32.06	29.01	29.67	24.90	45.43	Chi2=12.50; df=4; p=0.01	0.07
FSC2	30.15	25.73	44.12	31.30	29.77	38.93	25.52	25.93	48.55	Chi2=4.57; df=4; p=0.33	0.07
FSC3	27.94	27.94	44.12	30.53	25.95	43.52	22.20	25.10	52.70	Chi2=6.61; df=4; p=0.16	0.09
FSC4	28.68	38.23	33.09	32.06	42.75	25.19	25.93	36.31	37.76	Chi2=7.70; df=4; p=0.10	0.07
Environmental sustainability concerns (ESC)											
ESC1	31.62	38.97	29.41	30.53	44.27	25.20	28.63	34.23	37.14	Chi2=8.79; df=4; p=0.07	0.06
ESC2	31.62	32.35	36.03	32.82	36.64	30.54	26.35	33.82	39.83	Chi2=5.02; df=4; p=0.28	0.09

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

Valuing the culinary traditions of the region of origin was a factor associated with all statements on the scale. For concern for the environment, a significant positive correlation was observed. Thus, it can be concluded that greater concern for the environment was characterised by those who valued the culinary traditions of the region of origin to a greater extent (Table 7). Concern for food security and environmental sustainability correlated significantly, and negatively with appreciation of the culinary traditions of the region of origin. Hence, those who did not value the culinary traditions of the region of origin presented more positive attitudes towards concern for food security and environmental sustainability in terms of willingness to eat food containing edible insects in its composition (Table 7). By the results of previous studies, the highest likelihood of consuming insect-based foods was observed among those with high levels of diversity-seeking tendencies (Modlinska et al., 2021; Ribeiro et al., 2022). The influence of food choice motivations, such as convenience, health and ecological well-being, on the acceptance of insects as food and feed, was minimal among Norwegian and Portuguese residents (Ribeiro et al., 2022). Conversely, international travel is a significant factor influencing the perception of food product innovation among Polish

consumers aged 20 to 44 years. Travel experiences are a significant factor in food awareness, a source of knowledge about the positive characteristics of new foods, and a demand factor that determines the willingness to accept these innovations (Piwowar et al., 2023).

Table 7.

Concern for the environment, food security and environmental sustainability and valuing the culinary traditions of the region of origin

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	66.95	14.41	18.64	50.68	20.94	28.38	45.21	24.11	30.68	Chi2=28.15; df=4; p<0.01	0.18
EC2	59.32	16.10	24.58	39.19	31.08	29.73	33.70	27.67	38.63	Chi2=42.40; df=4; p<0.01	0.18
EC3	55.51	19.07	25.42	35.14	29.05	35.81	30.14	26.03	43.83	Chi2=41.68; df=4; p<0.01	0.22
Food security concerns (FSC)											
FSC1	32.20	20.76	47.04	30.41	32.43	37.16	33.15	26.85	40.00	Chi2=7.77; df=4; p=0.10	-0.05
FSC2	24.58	25.00	50.42	25.00	26.35	48.65	30.14	27.67	42.19	Chi2=4.77; df=4; p=0.31	-0.09
FSC3	22.46	22.46	55.08	22.30	30.40	47.30	27.12	26.03	46.85	Chi2=6.03; df=4; p=0.20	-0.08
FSC4	25.85	34.32	39.83	24.32	40.54	35.14	29.86	38.90	31.24	Chi2=5.73; df=4; p=0.22	-0.10
Environmental sustainability concerns (ESC)											
ESC1	25.85	35.59	38.56	25.68	40.54	33.78	33.42	36.16	30.41	Chi2=7.17; df=4; p=0.13	-0.10
ESC2	25.00	31.36	43.64	25.00	38.51	36.49	32.06	33.97	33.97	Chi2=8.17; df=4; p=0.09	-0.13

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

The level of health consciousness correlated significantly and positively with concern for the environment (from 0.24 to 0.30), and significant differences were observed in the frequency of responses to individual statements (Table 8). Those with low health consciousness and those with no opinion were significantly more likely to have a negative attitude towards caring for the environment (from 61.48 to 80.33% and from 47.65 to 62.42%, respectively). For the statement: „Food containing edible insects in its composition can protect a high demand for protein sources" a significant positive correlation was observed (Table 8). About concern for environmental sustainability, those with ambivalent attitudes predominated among those with low and no opinion on their health consciousness, while those with high health consciousness predominated among those with ambivalent and positive attitudes. For the statement: „Food containing edible insects can help reduce greenhouse gas emissions", a significant positive correlation was observed (Table 8). The results obtained for young consumers in Poland are consistent with research conducted among consumers in Germany (Kornher, Schellhorn, Vetter, 2019). Kornher, Schellhorn and Vetter (2019) showed that consumers' willingness to accept insects into their diet is strongly related to attitudinal variables such as preference for an environmentally friendly production method and health aspects (Kornher, Schellhorn, Vetter, 2019). Furthermore, Kornher, Schellhorn and Vetter (2019) indicate that the willingness to consume insects is highly correlated with the demand for low-

carbon products. Perhaps, consumers are already aware that growing and consuming insects can be a solution to environmental and health problems (Guiné et al., 2023; Kornher, Schellhorn, Vetter).

Table 8.

Concern for the environment, food security, environmental sustainability and high health consciousness

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	80.33	8.20	11.47	62.42	21.48	16.10	43.31	23.22	33.47	Chi2=68.02; df=4; p<0.01	0.29
EC2	67.21	15.57	17.21	52.34	26.17	21.48	33.68	26.57	39.75	Chi2=57.12; df=4; p<0.01	0.24
EC3	61.48	24.59	13.93	47.65	28.19	24.156	30.75	23.22	46.03	Chi2=66.54; df=4; p<0.01	0.30
Food security concerns (FSC)											
FSC1	36.07	25.41	38.52	31.54	30.20	38.26	31.59	24.90	43.51	Chi2=2.93; df=4; p=0.57	0.06
FSC2	29.51	28.69	41.80	28.19	32.21	39.60	26.57	24.27	49.16	Chi2=6.10; df=4; p=0.19	0.07
FSC3	26.23	30.33	43.44	26.85	30.87	42.28	23.64	23.01	53.35	Chi2=8.40; df=4; p=0.08	0.09
FSC4	27.05	40.98	31.97	28.86	40.94	30.20	27.20	35.98	36.82	Chi2=3.03; df=4; p=0.55	0.04
Environmental sustainability concerns (ESC)											
ESC1	30.33	42.62	27.05	28.19	45.64	26.17	29.71	32.64	37.65	Chi2=13.04; df=4; p=0.01	0.06
ESC2	31.15	36.07	32.78	31.54	39.60	28.86	26.78	31.80	41.42	Chi2=9.29; df=4; p=0.05	0.07

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

The level of physical activity was significantly, positively correlated with concern for the environment, and significant differences were observed in the frequency of responses to individual statements on the scale (Table 9). Persons with low physical activity were significantly more likely to have a negative attitude towards concern for the environment (44.03 to 58.44%, respectively). Those with no opinion on their physical activity were significantly more likely to have a negative and ambivalent attitude, and those with high activity, with a negative and positive attitude (Table 9). Regardless of physical activity towards the statement: „Foods containing edible insects in their composition can secure a high protein source demand”, respondents were significantly more likely to present a positive attitude (40.16 to 51.82%, respectively). No effect of physical activity on concern for environmental sustainability was observed (Table 9).

Table 9.*Concern for the environment, food security, environmental sustainability and physical activity*

Statements	No			I have no opinion			Yes			Chi2	Spearman's R
	[%]										
	N*	A	P	N	A	P	N	A	P		
Environmental concerns (EC)											
EC1	58.44	19.75	21.81	53.28	26.23	20.49	49.74	19.1	31.25	Chi2=11.42; df=4; p=0.02	0.08
EC2	47.74	27.57	24.69	37.70	30.33	31.97	41.41	21.09	37.50	Chi2=14.45; df=4; p=0.01	0.07
EC3	44.03	25.10	30.87	28.69	36.89	34.42	39.32	20.05	40.63	Chi2=19.24; df=4; p<0.01	0.06
Food security concerns (FSC)											
FSC1	29.22	25.51	45.27	35.25	32.79	31.96	3.33	24.22	42.45	Chi2=7.47; df=4; p=0.11	-0.01
FSC2	23.87	26.75	49.38	28.69	31.97	39.34	29.17	24.74	46.09	Chi2=5.24; df=4; p=0.26	-0.02
FSC3	24.69	24.69	50.62	22.95	36.89	40.16	25.26	22.92	51.82	Chi2=9.50; df=4; p=0.05	0.04
FSC4	23.46	39.92	36.62	28.69	42.62	28.69	29.69	34.90	35.41	Chi2=5.78; df=4; p=0.22	-0.02
Environmental sustainability concerns (ESC)											
ESC1	27.16	39.92	32.92	29.51	39.34	31.15	30.99	34.11	34.90	Chi2=2.90; df=4; p=0.59	0.00
ESC2	24.69	38.27	37.04	32.79	35.25	31.96	29.43	30.99	39.58	Chi2=6.02; df=4; p=0.20	0.01

Explanatory notes: *N – negative attitude. A – ambivalent attitude. P – positive attitude – attitude.

Source: own elaboration based on survey results.

Assuming a significance level of 5%, the statistically significant variables are: I am a person who pays attention to foods of high nutritional value (category no), I am a person who values the culinary traditions of the region of origin (category no), I am a person who is highly health-conscious (category no). In interpreting the individual variables, the odds ratio was used and they read as follows:

- People who do not pay attention to foods of high nutritional value are 93% more likely to have a more positive attitude towards environmental concern in terms of willingness to eat foods containing edible insects than people who pay attention to foods of high nutritional value, *ceteris paribus*;
- People who do not value the culinary traditions of the region of origin are about 36% less likely to have a more positive attitude towards environmental concern in terms of willingness to eat food containing edible insects than people who value the culinary traditions of the region of origin, *ceteris paribus*;
- People who do not consider themselves to be health-conscious are about 38% less likely to have a more positive attitude about environmental concern in terms of their willingness to eat food containing edible insects than those who are health-conscious, *ceteris paribus* (Table 10).

Table 10.

Model of lifestyle factors influencing attitudes towards environmental care in relation to willingness to eat food containing edible insects

Variable name	Category	Coef.	Std. Err.	Walda	95% confidence		p-value	OR
Free expression 1	-	-0.070	0.198	0.124	-0.458	0.318	0.725	0.933
Free expression 2	-	1.338	0.204	43.108	0.939	1.737	0.000	3.812
I am a person committed to work	no	0.027	0.117	0.055	-0.203	0.258	0.815	1.028
I am a person committed to work	don't know/don't have an opinion	-0.197	0.144	1.873	-0.478	0.085	0.171	0.822
I am a person committed to learning	no	0.342	0.217	2.493	-0.083	0.767	0.114	1.408
I am a person committed to learning	don't know/don't have an opinion	-0.039	0.227	0.030	-0.483	0.405	0.863	0.962
I am a pleasure-oriented person	no	-0.092	0.211	0.193	-0.505	0.320	0.661	0.912
I am a pleasure-oriented person	don't know/don't have an opinion	0.060	0.170	0.126	-0.272	0.393	0.722	1.062
I am a person who values the convenience and speed of food preparation	no	-0.098	0.223	0.192	-0.534	0.339	0.661	0.907
I am a person who values the convenience and speed of food preparation	don't know/don't have an opinion	0.062	0.207	0.089	-0.344	0.468	0.765	1.064
I am a person who pays attention to highly nutritious food	no	0.659	0.150	19.244	0.364	0.953	0.000	1.932
I am a person who pays attention to highly nutritious food	don't know/don't have an opinion	0.066	0.134	0.242	-0.197	0.329	0.623	1.068
I am a person who values the culinary traditions of an origin region	no	-0.308	0.109	7.922	-0.093	0.522	0.005	1.360
I am a person who values the culinary traditions of an origin region	don't know/don't have an opinion	-0.075	0.119	0.396	-0.308	0.158	0.529	0.928
I am a health-conscious person	no	-0.322	0.152	4.467	-0.023	0.620	0.035	1.379
I am a person with high health awareness	don't know/don't have an opinion	0.142	0.131	1.173	-0.115	0.400	0.279	1.153
I am a very physically active person	no	-0.138	0.112	1.506	-0.358	0.082	0.220	0.871
I am a very physically active person	don't know/don't have an opinion	-0.046	0.130	0.124	-0.301	0.209	0.724	0.955

Explanatory notes: * bold values are statistically significant.

Source: own elaboration based on survey results.

Assuming a significance level of 5%, the statistically significant variable is: I am a person who values the culinary traditions of the region of origin (category no). When interpreting the variable the odds ratio was used, it reads as follows: people who do not value the culinary traditions of the region of origin are about 22% more likely to have a more positive attitude towards concern for food security and environmental sustainability in terms of willingness to eat food containing edible insects than people who value the culinary traditions of the region of origin, *ceteris paribus* (Table 11).

Table 11.

Model of lifestyle determinants influencing attitudes towards food security and environmental sustainability on willingness to eat food containing edible insects

Variable name	Category	Coef.	Std. Err.	Wald	95% confidence		p-value	OR
Free expression 1	-	-0.685	0.189	13.221	-1.055	-0.316	0.000	0.504
Free expression 2	-	1.260	0.193	42.611	0.882	1.638	0.000	3.525
I am a person committed to work	no	-0.087	0.114	0.580	-0.310	0.137	0.446	0.917
I am a person committed to work	don't know/don't have an opinion	0.053	0.139	0.146	-0.220	0.326	0.702	1.055
I am a person committed to learning	no	0.054	0.205	0.071	-0.347	0.456	0.790	1.056
I am a person committed to learning	don't know/don't have an opinion	-0.031	0.220	0.019	-0.462	0.401	0.889	0.970
I am a pleasure-oriented person	no	0.337	0.203	2.754	-0.061	0.735	0.097	1.401
I am a pleasure-oriented person	don't know/don't have an opinion	-0.143	0.164	0.761	-0.464	0.178	0.383	0.867
I am a person who values the convenience and speed of food preparation	no	0.100	0.212	0.221	-0.316	0.515	0.638	1.105
I am a person who values the convenience and speed of food preparation	don't know/don't have an opinion	0.155	0.201	0.592	-0.240	0.550	0.442	1.168
I am a person who values the convenience and speed of food preparation	no	0.078	0.141	0.303	-0.199	0.354	0.582	1.081
I am a person who pays attention to highly nutritious food	don't know/don't have an opinion	0.244	0.130	3.512	-0.011	0.500	0.061	1.277
I am a person who values the culinary traditions of an origin region	no	0.245	0.108	5.195	0.456	0.034	0.023	0.783
I am a person who values the culinary traditions of an origin region	don't know/don't have an opinion	-0.069	0.118	0.344	-0.299	0.161	0.557	0.933
I am a health-conscious person	no	0.039	0.144	0.073	-0.244	0.322	0.787	1.040
I am a person with high health awareness	don't know/don't have an opinion	0.104	0.127	0.669	-0.145	0.352	0.413	1.109
I am a very physically active person	no	-0.186	0.109	2.898	-0.399	0.028	0.089	0.831
I am a very physically active person	don't know/don't have an opinion	0.061	0.127	0.233	-0.187	0.310	0.629	1.063

Explanatory notes: * bold values are statistically significant.

Source: own elaboration based on survey results.

4. Conclusions

The findings of the study enabled the confirmation of the research hypotheses that had been formulated. Hypotheses 1 and 2 were found to be partially confirmed. The results indicated a positive correlation between lifestyle determinants (i.e. commitment to learning, paying attention to the nutritional value of food, valuing the culinary traditions of the region of origin, health consciousness and physical activity) correlated positively with environmental concern in terms of willingness to consume food containing edible insects. The most important lifestyle determinant influencing students' attitudes towards environmental concerns, food security and environmental sustainability in the aspect of willingness to consume food containing edible insects was valuing the culinary traditions of the region of origin. Students who demonstrated an attachment to the culinary traditions of their region of origin demonstrated a more positive attitude towards environmental concerns. In contrast, respondents who did not express any attachment to the culinary traditions of their region of origin demonstrated positive attitudes towards concern related to food security and environmental sustainability. The results obtained indicate that among young consumers in Poland, it would be beneficial to implement initiatives that support activities aimed at ensuring food security, particularly in the context of environmental protection. Consequently, our study indicates that members of Generation Z in Poland may demonstrate a significant willingness to consume products with a low carbon footprint. Future research should aim to establish the relative importance and impact of several other factors on the acceptance of edible insects as food by young consumers (Generation Z) in Poland. These include the scale of experience with edible insects, the frequency of culinary tasting trips, and the level of variety-seeking tendency.

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