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Modelling the Factors Influencing Polish Consumers' Approach towards New Food Products on the Market

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Abstract: The sustainability of food systems and circular economy aspects are ending the traditional food approaches and are demanding changes in raw materials and products supplied by agriculture and the food industry. However, the "supply" of new products is the easiest to achieve, while gaining the acceptance of consumers for a new product will always be the toughest. For the consumer the new product is an item which until recently was not known or used. However, considering the newness of products concept on a scientific basis, it is obvious that the concept covers new, novel, and innovative food products. The study applies an advanced analysis of the factors that drive the consumers' acceptance of new products (perceived as new, novel, and innovative) on the food market in Poland. Specifically, seaweeds (as new), edible insects (as novel), and 3D-printed personalized food products (as innovative) were chosen. The selected factors influencing the Polish consumers' approach towards the newness of food products, including the different tendencies to accept innovations in this area, were analyzed by using factor and reliability analysis. The assessment of the differences towards an acceptance of new products based on the socio-demographic characteristics of the consumer was completed using the Kruskal–Wallis test. Furthermore, to analyze the features favoring the acceptance of new products, the logistic regression was estimated. The article presents the results of a survey of 500 Polish respondents in the 20–44 age group. The profound statistical analysis showed that the destiny of foreign travel turned out to be an important variable in the logistic regression model.

Keywords: consumer acceptance; food; innovation; Poland

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1. Introduction

The food industry is usually classified as a sector with a low innovation level as well as mediocre research and development (R&D) intensity concerning the state-of-the-art literature. This rule is reflected in one of the lowest R&D investments to sales ratios in any industrial sector and a relatively smaller number of patented inventions [1,2]. Such a profile of the market is related to the cultural heritage, which in certain points results in on-purpose "tradition-oriented" market strategy, where slogans such as "*the same recipe since 1920*" or "*grandma's secret recipe*" are often emphasized [3]. It is worth noting that the customer target of such companies is consistently groups of either older or tradition-oriented customers. Therefore, when introducing new strategies, the food companies usually target specific groups of the population who are more self-aware and are able to make choices on a health or wellbeing basis, and usually economically independent. Locally, the market may not change as much, but globally it is constantly twisting towards more demanding challenges.

At present, the pace and direction of the innovative activities of many global operating food companies are determinants of the market position. Innovation is treated here as an imperative for the development of the modern food economy, both in technological and organizational aspects. On the one hand, it is a condition for improving the competitiveness of economic entities, and on the other, it is a response to increasingly diversified consumer expectations [4]. However, in all the aspects, the business entities need to consider the potential financial benefits which are related with product sales first. Specific branches of the food market suffer from different economic problems. For example, previous research has shown inefficiencies of dietetic food manufacturing firms in Europe in five countries representing Western, Southern, Eastern, and Northern European regions [5].

The food sector is facing constant changes in food production, determined not only by demographic and behavioural changes, but also by climate challenges [6,7]. However, the responsibility in terms of the sustainable development and reduction in the environmental impact of industrial scale processes applies not only to the food industry, but also to agriculture and the entire food supply chain [8]. Hypothetically, all the changes and adjustments can be met by business entities when sales of their products cover the cost of the changes. Therefore, consumers now are influencing the directions of food production more and more.

Consumer trends lead to a sharp increase in the supply of specific food products, including functional food [9,10]. Sustainability goals and the circular economy approach have brought different raw materials and production methods into the food industry to try to meet the demand with a certain economic efficiency.

Among the latest trends in innovation in the food industry, the use of edible insects can also be distinguished [11–13]. The use of insects for food production is important in mitigating the negative effects of climate change [14,15]. Edible insects are an alternative source of protein, mainly meat, and many other biologically active and nutritious ingredients, so they can be an important element of sustainable food production [16–20]. However, the study by Naranjo-Guevara et al. [21] shows that there is a greater acceptance for the use of insects as an animal feed than in human food. Many authors have indicated the importance of the rearing and eating of edible insects from the food security point of view [22,23]. Entomophagy is also becoming an interesting alternative in Western countries. Researchers are extensively studying the acceptance of eating insects in European countries, taking into account the cultural differences among people of different ages [24–27].

Another trend relates to the usage of seaweeds as a food source [28,29]. Commonly consumed in Asia, in the Western world they are a largely unexploited food source with low trophic and renewable characteristics [28]. Seaweed itself brings health benefits including cardiovascular and anti-inflammatory protection and can act as constitute ingredient for the food industry in the development of value-added food products [29,30]. The barriers for seaweeds as food include food safety, quality preservation and optimization, and food neophobia. Consumer attitudes towards edible seaweed have been studied in the European context, for example among Italian consumers [31].

Meanwhile, an innovation that has completely redefined the possibilities of food formulation (custom shapes, colours, adaptation of texture and nutritional value to the target group, etc.) is 3D printing [32–34]. As 3D printing (also known as an additive manufacturing) is at a relatively early stage of implementation in the area of food production, there are few studies concerning the consumers' perception of such food [35,36]. In Europe, Brunner et al. [37] examined the attitudes of Swiss citizens towards 3D-printed food, and the data were collected through a questionnaire sent by post. These studies showed that consumers in general had a relatively low initial knowledge regarding a 3D-printed food. Frewer et al. [38] noticed in a study on the acceptance of food technology by consumers that the methodological approach used was mostly based on surveys.

Food-producing enterprises look for new opportunities and prospects for market development and for building relationships with consumers. Obviously, companies behave differently depending on their market position and dominant "orientation" towards a

product, process, or market [39]. External sources of knowledge in the search for products and technologies, including strategies combining internal ideas with external knowledge, are very important [2,40–42]. Nevertheless, the basis for action is the knowledge of the needs, expectations, possibilities, and limitations of consumers in the area related to specific food consumption. Concerning the objective of this study, it is especially important to take into account the attitudes of consumers towards market novelties, perception of benefits, risk, and uncertainty.

The food industry is one of the most important branches of the national economy in Poland. Moreover, the other sectors of agribusiness are very well developed [43]. An unquestionable impulse for the accelerated development of the food industry in Poland was the accession to the EU in 2004 [44]. Among the new EU member states, Poland has achieved a relatively high gross added value in agriculture and a high, positive balance of trade in agri-food products [43,45]. The scientific literature indicates that the level of competitiveness of the food industry enterprises in Poland increased after the European Union accession. In the early years, cost and price benefits were visible [46], while at present, aspects related to innovation and effectiveness of marketing management are more important.

The consumer acceptance of any innovation is obviously conditioned by many psychological and socio-demographic features of the consumer [47,48]. The characteristics of a new food product, such as price, convenience of use, taste, and general appearance determine the acceptance of a new food product [49]. Consequently, more general aspects such as environmental considerations appear to be perceived by consumers as benefits of innovation on the market. On the one hand, edible insects and seaweed exploitation in human nutrition are answers to consumers' expectations, as they are important both from an environmental and economic point of view. Seaweed exploitation in particular may provide nutritional benefits as a food product rich in carotenoids and polyunsaturated fatty acids with antioxidant properties [30,50]. On the other hand, 3D printing can be used for the production of ready-to-eat foods for people with specific food-related diseases and with personal nutritional habits, can be used to reduce the problem of the lack of food in the developing countries, and can contribute to the reduction in food waste and the improvement of the environmental sustainability [51]. Despite increasing scientific research in the European context into the potential use of edible insects [30], seaweed [31], and 3D printing [37], in Poland many issues related to the determinants of their consumption and usage have not yet been clarified. Particularly noteworthy in this context is the research on consumer preferences, beliefs, and biases towards these new groups of food products.

Based on the aforementioned, the objective of this study was to identify and analyse the conditions for the acceptance of new (including new—seaweed, novel—edible insects and innovative—3D printing) food products among Polish consumers. The authors formulated several research questions:

- What are the most important features of the new food for the consumer in Poland?
- What is the attitude of Polish consumers to the innovations on the food market distinguished in the survey?
- Are there any differences in attitude to new products on the market under investigation related to the consumer's socio-demographic characteristics? What features favour the acceptance of new products?

There is a research gap in this area, not only in Poland but also in other countries of Central and Eastern Europe, which are known for their traditional and regional culinary practices. The protection of the natural and economic environment is an important element that can be taken into account both at the macroeconomic level (e.g., in the social policy of the state) and at the microeconomic level—in the marketing strategies of enterprises on the food market. Knowledge about consumer behaviour and the factors shaping it in the context of new food products plays a very important role in the socio-economic area. Successful commercialization of new food products requires, first and foremost, a deep understanding of consumer product perception that determines rejection or acceptance [52].

The article consists of four main parts. After the introduction, the research methodology and characteristics of the research sample are presented, as well as the type of the respondents and their location, including the motivations regarding these choices. The third section presents the results of the empirical research, followed by a discussion in the fourth section. The article concludes with a summary, in which the most important conclusions are indicated, as well as limitations and future research directions within the scope of the presented considerations.

2. Materials and Methods

The self-designed and validated questionnaire survey answers were the main source of information. The research tool contained 16 questions in the main part and 8 in the demographics part. Nominal and ordinal scales (including a 5-point Likert scale) were used in the construction of the survey.

The study was commissioned by a specialized research agency and carried out by experienced interviewers, and their work was monitored on an ongoing basis by coordinators. Additionally, 20% of the interviews were verified in terms of their correct conduct by specialized employees of the contractor–controllers.

The sample size was 500 respondents, and the study used a random–stratified selection from the sampling frame of people living in the selected cities with over 300,000 inhabitants: Wrocław, Kraków, Warszawa, Gdańsk, and Lublin, in a specific age group (20–44 years old).

The choice of the cities was dictated by both their location (one city each from the central, western, eastern, northern, and southern parts of Poland) and their size (measured by the number of residents). The basic criterion for their selection was the classification of the largest cities in Poland in terms of the number of residents, and all selected cities are in the top 10 in this ranking. Warsaw, Krakow, and Wroclaw are the 3 largest cities in Poland (located in central, southern, and western Poland, respectively), while Gdansk and Lublin are large cities in the north (Gdansk) and east (Lublin) of Poland. Big cities were chosen due to previous observations of consumption patterns confirmed by different authors [53–55]. Large cities in Poland are in the process of rapid population concentration and economic activity [56].

In turn, the establishment of limiting numbers with regard to the age of the respondents surveyed (20–44 years), was important from several aspects. The purpose of our research was to analyze the behavior of working-age residents from selected Polish cities, including in particular the identification of relationships within "Generation Y" (Millennial Generation, Generation Next, Net Generation). Since Poland's Statistical Office distinguishes the 20–44 age group, the same age group of respondents was chosen for the empirical study. In addition, according to studies by other authors in a similar subject area, this is the group that particularly stands out for its high openness to new foods in Poland [57].

Table 1 shows the size of the research sample specified by place of residence and gender of the respondents.

Table 1. The size of the sample taking into account gender and place of residence.

Specification	20–24 y			25–29 y			30–34 y			35–39 y			40–44 y		
	Total	Men	Female	Total	Men	Female	Total	Men	Female	Total	Men	Female	Total	Men	Female
Wrocław	11	5	6	16	8	8	26	12	14	26	13	13	21	10	11
Lublin	12	6	6	18	9	9	25	12	13	24	12	12	21	10	11
Kraków	11	6	5	17	8	9	26	13	13	25	12	13	21	10	11
Warszawa	10	5	5	15	7	8	24	11	13	27	13	14	24	11	13
Gdańsk	12	6	6	17	8	9	24	12	12	24	12	12	22	11	11

Source: own study based on questionnaire surveys (N = 500).

Considering the characteristics of the studied group (age, their availability and willingness to participate in the research) as well as providing the respondents with the comfort of

completing answers, the survey was carried out using a phone interview technique with a questionnaire (CATI). The survey was conducted in the period of June–July 2020. Table 2 provides information on the characteristics of the research sample.

Table 2. General characteristics of the test sample.

Attribute	Category	n	%
Gender	Female	257	51.4
	Male	243	48.6
Age	20–24 y	56	11.2
	25–29 y	83	16.6
	30–34 y	125	25.0
	35–39 y	126	25.2
	40–44 y	110	22.0
Place of residence (city)	Warszawa	100	20.0
	Gdańsk	100	20.0
	Kraków	100	20.0
	Wrocław	100	20.0
	Lublin	100	20.0
Education	Primary	1	2.2
	Vocational school graduates	13	6.2
	Secondary	116	44.8
	Higher	127	46.8
The number of household members	1	33	6.6
	2	99	19.8
	3	149	29.8
	4	135	27.0
	5 and more	84	16.8
Income	<1000 PLN	22	4.4
	1001–2000 PLN	100	20.0
	2001–3000 PLN	151	30.2
	3001–4000 PLN	98	19.6
	>4000 PLN	129	25.8
Foreign travel	No	96	19.2
	Yes	404	80.8

Source: own study based on questionnaire surveys (N = 500).

Data analysis was performed based on factor analysis and reliability analysis [58]. A summary variable was determined by summing up the answers from 7 questions of the scale. The minimum score was 7 points, while indicating "1-definitely negative" for each question up to 35 points, while choosing "5-definitely positive" for each answer.

The Kruskal–Wallis test was performed to assess if there were statistically significant (for the significance level alpha = 0.05) differences in attitude to new products on the market related to the socio-demographic characteristics of the consumer. In order to indicate the features favouring the acceptance of new products, a binomial logistic regression model was estimated [59]. People participating in the study were divided into two groups, where the criterion of partitioning was the approach towards new products on the market. The first group consisted of people positively evaluating new food, for whom the total variable ranged from 28 to 35 points. The second group gathered the rest of the respondents—people who obtained from 7 to 27 points.

The binary dependent variable Y took the form:

$$Y = \begin{cases} 1 - acceptance\ of\ innovative\ products\ on\ the\ food\ market \\ 0 - lack\ of\ opinion\ or\ negative\ assessment\ of\ innovative\ products \end{cases}$$

Potential explanatory variables are listed in Table 3.

Table 3. Explanatory variables in the logistic regression model.

Gender	nominal variable with a value of 1 for men and 0 for women
Age	ordinal 5-state variable, for which four 0–1 variables were introduced, taking people aged 20–24 as a reference variable
Place of residence	nominal 5-state variable, for which four 0–1 variables were introduced, taking Warsaw as a reference variable
Education	ordinal 2-state variable with the value 1 for higher education and 0 for lower than higher education
Income	ordinal 5-state variable, for which four 0–1 variables were introduced, taking "do 1000" as a reference variable
The number of household members	ordinal 5-state variable, for which four 0–1 variables were introduced, taking "1" as a reference variable
Travel abroad	nominal variable with a value of 0 for "no" and 1 for "yes"
Asia	nominal variable with a value of 0 for "no" and 1 for "yes"
Africa	nominal variable with a value of 0 for "no" and 1 for "yes"
North America	nominal variable with a value of 0 for "no" and 1 for "yes"
South America	nominal variable with a value of 0 for "no" and 1 for "yes"
Australia/Australasia/Oceania	nominal variable with a value of 0 for "no" and 1 for "yes"
Traditional Polish cuisine	nominal variable with a value of 0 for "no" and 1 for "yes"

The list of factors included in the survey questionnaire was developed based on data from previous scientific studies [60,61], including the authors' own research in this paper [62,63]. The analysis of this study also included also some additional factors, among others the destinations of the travel abroad.

Statistical analyses were performed with the use of statistical software: IBM SPSS 25.0 and Statistica 12.5.

3. Results

The research attempted to identify the most important features of new food products for consumers. The respondents could indicate the factors influencing the choice of new food products (Table 4).

Table 4. Factors influencing the choice of new food products.

Specification	Units	Taste	Appearance	High Nutritional Value	Price	Environmental Benefits	Food Safety	None of the Listed
Food products consisting exclusively or principally of seaweed	n	278	141	188	147	108	115	68
	%	55.6	28.2	37.6	29.4	21.6	23	13.6
Food products with added seaweed	n	233	143	185	149	111	109	61
	%	46.6	28.6	37	29.8	22.2	21.8	12.2
Food products consisting exclusively or principally of edible insects	n	139	116	130	90	66	96	185
	%	27.8	23.2	26	18	13.2	19.2	37
Food products with added edible insects	n	154	124	110	104	66	84	181
	%	30.8	24.8	22	20.8	13.2	16.8	36.2
3D-printed food products	n	152	122	81	139	108	118	166
	%	30.4	24.4	16.2	27.8	21.6	23.6	33.2

Source: own study based on questionnaire surveys (N = 500).

Taking into account the food produced on the basis of seaweed, the most important factor that would affect the respondents' choice of these food products was taste (Table 4). This factor was significant for 55.6% of respondents when the food product consisted entirely or mainly of seaweed, and 46.6% for those surveyed when it was for products with added seaweed. Among the food characteristics considered in the consumer acceptance of seaweed-based food products, high nutritional value, price, and appearance were also described as important factors.

However, the most important factors determining the acceptance of innovative products based on edible insects and products made with by 3D printing were taste, appearance, and price. Attention is drawn to the high percentage of responses classified as "none of the listed", which may indicate the substantial lack of knowledge of the respondents in relation to the subject matter of the study.

The analysis shows that 42% of the respondents were sceptical about the use of insects as one of the main directions of development in the food industry (Table 5).

Table 5. Opinions of the respondents regarding the selected directions of the food market development.

Specification	Units	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
"The use of insects is one of the main directions of development in the food industry"	n	122	88	132	78	80
	%	24.4	17.6	26.4	15.6	16.0
"In the coming years, the food market in Poland based on 3D printing will develop"	n	67	68	200	90	75
	%	13.4	13.6	40.0	18.0	15.0

Source: own study based on questionnaire surveys (N = 500).

Additionally, 26.4% of the respondents had no opinion on this subject. The results of this analysis are similar to the results of other authors. The research by Zielińska et al. [64] proved that Polish consumers have a limited knowledge of entomophagy and therefore the readiness to eat insects is significantly limited. Moreover, previous studies have indicated that the low tendency of young consumers to adopt edible insects results from psychological barriers dealing with a phenomenon known as neophobia, i.e., rejection by some people of new or unknown food [62]. Moreover, almost half of the respondents had no opinion about the prospects for the development of 3D printing technology on the food market in Poland. Positive responses (jointly "I rather agree" and "I strongly agree") accounted for 32% of the total responses.

The main concern of the research was the attitude of the respondents to novel foods. It is worth emphasizing that as many as 98.6% of respondents, when assessing their attitude to new products on the food market, declared their openness to new products. The respondents also highly rated their knowledge of new food products. The analysis shows that over 70% believed that they were very good at or well informed about new products. However, when assessing the innovations on the food market included in the survey, the respondents were not so unanimous, as shown in Table 6 by percent distribution of responses to the main question of the survey.

Half of the respondents assessed negatively (definitely negatively or rather negatively) genetically modified food of animal origin and meat grown in cells in the laboratory, while every fourth respondent positively assessed innovations in this area (Table 6). The respondents' most trusted innovations were related to food consisting of or extracted from microorganisms, fungi, or seaweed (40.2%) and the use of 3D printers in food production (37.4%). It should also be noticed that a large proportion of the respondents chose a neutral variant of the response when assessing innovation—from 21.6% in the case of genetically modified plant products to 37.8% in the case of food consisting of or isolated from microorganisms, fungi, or seaweed.

In order to assess the relationship between the seven questions presented above regarding the assessment of technological and product innovations on the food market, factor analysis was

applied using the principal component method to extract factors and the Kaiser value criterion for selecting the number of factors. The obtained results are presented in Table 7.

Table 6. Consumer assessment of technological and product innovations on the food market.

How Do You Evaluate the Organizational, Technological and Product Innovations on the Food Market Listed in the Table below? (in %)					
Factor	**Very Negative**	**Negative**	**Neutral**	**Positive**	**Very Positive**
			[%]		
1. Genetically modified food (plant products)	18.6	22.4	21.6	21.6	15.8
2. Genetically modified food (animal products)	24.0	26.2	23.6	16.6	9.6
3. Foods consisting of or isolated from microorganisms, fungi, or seaweed	6.8	15.2	37.8	26.8	13.4
4. Product innovations based on edible insects	20.6	22.0	26.8	17.8	12.8
5. Use of printers in food production (3D printing)	13.8	17.8	31.0	22.2	15.2
6. Cell-grown meat in the laboratory	25.4	22.8	28.6	11.8	11.4
7. A fully balanced powdered meal	15.8	20.4	29.2	23.4	11.2

Source: own study based on questionnaire surveys (N = 500).

Table 7. The results of the factor analysis.

Kaiser-Mayer-Olkin Test	
KMO measure of sampling adequacy	0.818
Bartlett sphericity test	
Approximate chi-square	1502.93
df	21
significance	0.000
Variable	Factor Loadings
1. Genetically modified food (plant products)	0.805151
2. Genetically modified food (animal products)	0.784677
3. Foods consisting of or isolated from microorganisms, fungi, or seaweed	0.685138
4. Product innovations based on edible insects	0.636274
5. Use of printers in food production (3D printing)	0.692939
6. Cell-grown meat in the laboratory	0.797427
7. A fully balanced powdered meal	0.678767
Eigenvalue	3.715023
Share	0.530718

The value of the K-M-0 measure = 0.818 proves the reliability of the conducted factor analysis, and the significant Bartlett sphericity test means that the factor model was appropriate for the analysed variables as they were statistically significantly related to each other. The sufficiently high values of the factor loadings for all the variables that make up a single factor were obtained (the eigenvalue of the factor 3.71), proving the single-factor structure of the examined variables, and justifying the development of a summary scale.

In the next step, in order to assess the reliability of the scale reflecting the degree of acceptance of innovations on the food market, the reliability analysis was used (Table 8). The Cronbach's alpha coefficient assumed the desired high value of 0.85, which proves the internal consistency of the adopted set of variables. Scale items correlated with a total cumulative score greater than 0.51 and removing any item would have reduced Cronbach's alpha.

The obtained results after the use of factor and reliability analysis confirm the validity of the construction of the aggregate variable, illustrating the attitude of the respondents to new products on the food market, referred to in the work as "acceptance". The constructed variable took values from 7 in the case of a strongly negative assessment (value 1) of all seven considered innovations to 35, in the case of a strongly positive assessment (value 5) for each of them.

Table 8. Results of the reliability analysis.

Scale summary: Mean = 20.2220 Std dev = 6.39049 N valid: 500 Cronbach's alpha: 0.850857 Standardized alpha: 0.850720 Avg Cor. between items: 0.459068				
Item	Average of the Scale after Deleting an Item	Scale Variance after Deleting an Item	Total Item Correlation	Cronbach's alpha after Deleting an Item
1. Genetically modified food (plant products)	17.286	28.946	0.695	0.817
2. Genetically modified food (animal products)	17.606	29.83	0.673	0.821
3. Foods consisting of or isolated from microorganisms, fungi, or seaweed	16.974	32.615	0.571	0.836
4. Product innovations based on edible insects	17.42	31.603	0.514	0.845
5. Use of printers in food production (3D printing)	17.15	31.25	0.575	0.835
6. Cell-grown meat in the laboratory	17.612	29.404	0.697	0.817
7. A fully balanced powdered meal	17.284	31.599	0.558	0.838

In the subsequent analysis, the Kruskal–Wallis test was used to assess the statistical significance of the differences in attitude to new products on the market between groups distinguished based on the selected socio-demographic characteristics of the respondents. The results are presented in Table 9.

Table 9. The acceptance of innovations on the food market according to selected socio-demographic characteristics and the Kruskal–Wallis test *p*-value.

Feature	Category	Mean	Standard Deviation	Minimum	Maximum	The *p*-Value from Kruskal–Wallis Test
	Total	**20.22**	**6.39**	**7**	**35**	
Gender	Female	20.18	6.22	7	35	0.8882
	Male	20.17	6.68	7	35	
Age	20–24	20.95	5.50	8	35	0.3461
	25–29	20.01	5.65	7	35	
	30–34	20.38	6.06	10	35	
	35–39	20.75	6.92	7	35	
	40–44	19.22	7.02	7	35	
Place of residence	Warszawa	21.23	6.92	7	35	0.2627
	Wrocław	19.75	6.46	7	35	
	Kraków	20.21	5.32	9	35	
	Lublin	20.58	6.55	7	35	
	Gdańsk	19.34	6.55	7	35	
Education	Primary and vocational school graduates	20.55	5.46	7	35	0.8564
	Secondary	20.33	6.44	7	35	
	Higher	20.06	6.51	7	35	
The number of household members	1	21.33	6.21	13	35	0.3226
	2	19.12	6.51	7	35	
	3	20.67	6.19	7	35	
	4	20.27	6.55	7	35	
	5 and more	20.21	6.37	7	35	
Income	<1000 PLN	18.75	6.39	7	35	0.0938
	1001–2000 PLN	20.58	6.36	7	35	
	2001–3000 PLN	20.21	5.72	8	35	
	3001–4000 PLN	20.66	6.71	7	35	
	>4000 PLN	21.91	6.89	12	35	
Travel abroad	No	19.95	6.35	7	35	0.6406
	Yes	20.29	6.41	7	35	
Asia	No	19.67	6.22	7	35	0.0024
	Yes	21.58	6.61	7	35	
Africa	No	19.86	6.19	7	35	0.0059
	Yes	21.93	7.05	7	35	
North America	No	19.94	6.22	7	35	0.0231
	Yes	21.73	7.09	7	35	
South America	No	19.85	6.29	7	35	0.0225
	Yes	21.37	6.59	7	35	
Australia/Australasia/Oceania	No	19.84	6.29	7	35	0.0001
	Yes	23.45	6.40	10	35	
The preference for traditional Polish cuisine	No	21.31	6.02	7	35	0.0016
	Yes	19.46	6.54	7	35	

For the adopted level of significance (alpha = 0.05), there were statistically significant differences in the assessments of innovations on the food market and travels to non-European continents and the preference of traditional Polish cuisine. People declaring trips abroad to Asia, Africa, North America, South America, Australia, and Oceania, as well as people who preferred Polish cuisine other than traditional, showed a greater acceptance of innovations on the food market.

To assess the extent to which the distinguished features (variables) affect the acceptance of innovation, a logistic regression model was estimated (see Table 10). When estimating the logistic regression models, various sets of explanatory variables were taken into account, both those that were characterized by a statistically significant (in the Kruskal–Wallis test) relationship with the dependent variable, and those whose influence was not confirmed.

Table 10. Estimation results of the logistic regression model for accepting innovations on the food market in Poland.

Variable	B	SE	Wald	df	Significance	Exp(B)
Traditional Polish cuisine 1–0	−0.354	0.266	1.769	1	0.183	0.702
Africa 0–1	0.801	0.316	6.423	1	0.011	2.227
Asia 0–1	0.087	0.298	0.085	1	0.771	1.091
South America 0–1	−0.063	0.400	0.025	1	0.875	0.939
North America 0–1	0.187	0.320	0.340	1	0.560	1.205
Australia/Australasia/Oceania 0–1	0.211	0.436	0.235	1	0.628	1.235
Constant	−1.885	0.234	65.069	1	0.000	0.152

Goodness of fit statistics: Hosmer Lemeshow = 4.1461, p = 0.528578, % correct predictions = 86%.

Ultimately, for the adopted significance level alpha = 0.05, the only significant variable in the model was the place of foreign travel—Africa. The chance of accepting innovations on the food products market was twice as high among people who travelled to Africa in 2009–2020 compared to others.

4. Discussion

Polish society has had a free-market access to food for only 30 years. Until 1989, there was a goods distribution control system in Poland, including food rationing [65]. The socio-economic transformations that took place after 1989 led to many rapid and profound changes on the food market in Poland. On the supply side, production was marketed, labor efficiency improved, and production adjusted to European requirements. In the production and trade of food, the importance of the position of large companies, including transnational corporations, increased, with the share of small companies decreasing at the same time [66]. On the demand side, there has been a change in consumer eating behavior, which is now characterized by large internal variation. Varied food consumption in socio-economic and income groups is especially important. The fundamental difference concerns the consumption patterns in cities and in rural areas, which became significantly different. However, many studies have indicated a low level of innovation in the choice of food by Polish consumers [67] emphasizing that older people are generally more wary of new market developments [68]. Considering the acceptance of new products on the food market, young people (e.g., born after 1995, representatives of so-called Z generation), with a university level of education and a good income, may now be of particular importance as customers in Poland [62,69]. The research by Sajdakowska et al. [70] showed that the young generation of Poles are relatively more open to new food products, which is correlated with the wide range of food products available on the open market.

As mentioned in the introduction, the number of research projects and publications on the research problems/questions addressed in this article within Poland is not large [56].

A study conducted by Bogusz et al. [71], on a sample of 310 Poles, showed that Poles' knowledge of edible insects and the possibility of consuming them is insufficient.

In general, previous studies on the acceptance of new food products based on edible insects conducted in Poland have been mainly based on relatively small research samples. In a study by Bartkowicz [72], which aimed to identify the determinants affecting the acceptance of a new products containing edible insects in the form of powdered house cricket *Acheta domesticus* L., the study sample was 114 people. Moreover, the geographical and age range was very limited, the sample selection for this research was purposive, and the research involved dietetics' students in the city of Gdansk. Considering the results of the study, more than half of the respondents showed willingness to consume smoothies as presented in the sensory consumer evaluation.

In contrast, a study by Kostecka et al. [73] showed that consumers in Poland are aware of environmental challenges in the context of food (including the environmental pressures of traditional animal husbandry) and that edible insects have some environmental benefits. However, the majority of respondents were still unwilling to eat insects. Similarly, a study by Modlinska et al. [74] showed that the acceptance of insects as an alternative to meat does not necessarily translate into a willingness to buy and eat them. Consumers who, as a general perspective, declare an acceptance of insects as a meat substitute may not want to buy insects for consumption. This was the conclusion presented by the authors of this representative research in the Polish population, conducted on a sample of 1096 people.

More advanced research in this area also includes a study of the key factors influencing the process of acceptance of edible insects by Polish consumers, which was conducted in selected cities in northern Poland (Gdansk, Gdynia, Sopot), on a sample of 788 people between the ages of 16 and 80 [58]. According to this research, the degree of seeking diversity in food significantly depends on factors such as gender, age, and education.

Moreover, with regard to the other innovations in the Polish food market addressed in this paper, there are relatively few references in the literature. An assessment of the knowledge of food production technology using 3D printing and its perception by consumers in Poland was conducted by Klockiewicz and Samotyja [75]. On the basis of a survey of a sample of 406 individual consumers, most of whom were under 40 years of age, they observed a relatively poor knowledge of the possibility of producing food using additive technology. Nearly 60% of respondents had not heard of such a possibility before.

In conclusion, the research presented in this work mostly shares the presented conclusions from the literature. Nevertheless, the contribution of this work to the area of knowledge related to the acceptance of new, novel, and innovative food products on the Polish market concerns the analysis of factors relating to the respondents' dossiers (mainly trips abroad), which has not been the subject of broader analysis so far. In addition, the novelty is the juxtaposition of various new, novel, and innovative products/techniques in the research questions and the development of results on this basis. Thus, the novelty also applies to the methodological layer, including the research questions and the construction of the survey questionnaire.

5. Conclusions, Limitations, and Future Research Directions

Food should not only satisfy physiological nutritional needs, but also personal and social desires and expectations. Present and future trends on the food market are largely related to social and environmental changes; hence, there is a growing popularity of market and scientific research on the use of seaweed, insects, etc., for nutritional purposes. In this study, data collected from a consumer sample (N = 500) in Poland were analysed in order to learn and better understand the degree of acceptance of the novel food, including the use of insects, seaweed, and 3D printing technology.

The research revealed different attitudes towards product and technological innovations in the field of food. Overall, consumers were quite sceptical about ground-breaking and radical food innovations. The factors of perception of innovations on the food market were identified. The added value (e.g., positive impact on the natural environment), in the

opinion of most respondents, did not outweigh the sensory properties of innovative food and the economic aspect. The main conditions for acceptance were taste, nutritional value, and appearance.

A multivariate model was defined and estimated to investigate the simultaneous effects of socio-demographic, past experience, cognitive, and attitudinal factors. According to the analysis, traveling abroad is an important factor influencing the perception of innovation in food products. Tourism experiences are an important factor in nutritional awareness, a source of knowledge about the positive qualities of novel foods, and a demand factor that determines the willingness to accept these innovations. Tourists with different socio-demographic characteristics, and past experience may have the same motivations towards novel food consumption. The relationships found may have important implications for both private and public stakeholders in the food sector in Poland.

An important limitation of the study is its restriction to the 20–44 age group of consumers located in large cities. The sample is not representative of the entire Polish population. It is cognitively interesting to study behavior on a representative sample of the general Polish population, including a large group of rural residents. Emerging markets, based on seaweed, insects, and new manufacturing techniques, still face challenges of consumer acceptance and uncertainty about their preferences, which will prompt further research initiatives in this area.

This article may be the basis for further analysis, e.g., on the influence of ingredients used in the process of food production in the 3D technique on consumer acceptance. Further research is also needed in order to understand better the negative and neutral causes (neither positive nor negative) of respondents' responses to the evaluation of innovative food products manufactured, e.g., based on insects and seaweed.

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