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PERCEPTION OF ORGANIC, FUNCTIONAL AND GENETICALLY MODIFIED FOODS – A STUDY AMONG CONSUMERS IN GDYNIA, POLAND

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Purpose: The main objective of the research was to identify the factors, including gender and generation, which affect the decision-making process of purchasing and consuming organic, functional, and GMO foods.
Design/methodology/approach: The research instrument was a survey questionnaire administered through the CAWI method using Google forms. The survey was conducted in spring 2023 among a group of 194 respondents in Gdynia, Sopot and Gdansk in the Pomeranian Voivodeship (Northern Poland). To select the respondents for the survey sample, the snowball sampling technique was used. They also acknowledged the inherent risk factors associated with conducting an interview using the CAWI method. The interview questionnaire consisted of thematic blocks including scales on: subjective self-assessment of health and diet, attitudes towards organic food, functional food, GMOs and health and health values of food.
Findings: The assessment of respondents' attitudes towards different types of food: organic, functional and GMO foods, as well as health and health values of food, showed mostly ambivalent attitudes of respondents in the subject studied.
Research limitations/implications: The research carried out has certain limitations. The identification of factors influencing the attitudes of consumers belonging to generations X, Y, Z towards organic, functional and GMO food, as well as the health and health values of food, was carried out using a snapshot sample of the inhabitants of Gdynia. The results of the survey are therefore not representative of the entire Polish population and should be interpreted with caution.
Practical implications: The results of this study can be used as a basis for discussion and consideration of the development of intelligent food systems using information and communication technologies (ICT). These systems will provide consumers (Generations X, Y, Z) with knowledge about the range and quality of organic, functional and GMO foods and help to meet the nutritional needs of societies.

Social implications: The research conducted is part of health risk management and health promotion in the Polish population.
Originality/value: The results of the pilot study indicate that respondents' knowledge of the nutritional value and safety of organic, functional and GMO products is very low. Changing respondents' attitudes from ambivalent to positive towards organic and functional foods will lead to an expansion of the range of foods consumed and minimise the risk of developing non-communicable diseases, including metabolic and cardiovascular diseases.

Keywords: attitudes to food, quality of food, quality of life, health, consumer behaviour of generations X, Y, Z.

Category of the paper: Research paper.

1. Introduction

The complexity of consumer behaviour makes it challenging to determine, given the numerous internal and external factors that contribute to it. The study of such behaviour is a difficult process. The various determinants of consumer behaviour aid in market development, as new facilities and bespoke products and services are created to meet their needs (Bilska et al., 2012). Understanding consumer behaviour is crucial for creating and executing a successful course of action for any business in the market. This knowledge empowers businesses to shape consumer choices (Górska-Warsewicz, 2017).

The environment surrounding consumers is highly varied and complex, particularly in terms of the stimuli which impact them directly (Grębowiec, 2018). This environment is shaped by socio-cultural, personal, and psychological factors. Personal factors arise from individual attributes like age, gender, personality, preferences, needs, interests, hobbies, opinions, and financial status. Psychological factors include higher-order needs. These include the needs for self-actualisation, motivation, esteem, belongingness, recognition (Rybowska, 2018). A consumer's motivation to take action depends on his or her personality and motives, while the choice of a product and the final decision to purchase it depend on the consumer's attitude towards the object, which is the result of the consumer's evaluation of the product and beliefs (Jeżewska-Zychowicz, 2009).. Socio-cultural factors are: culture, subculture, status, education, family, friends, social groups, work. Culture sets the framework in shaping our social norms, values and perception of needs. It influences how consumers make decisions and their purchasing behaviour (Gawęcki et al., 2000; Bilska et al., 2012).

The consumer environment is greatly influenced by market conditions relating to factors such as demographic, social, economic, competition and technological advances. Demographic factors, such as population, number of people in the household, age and income level, can influence consumer demand for goods and services. The significance of these rules originates from prevailing social and cultural norms, which dictate gender and age-appropriate

behaviours. The violation of said norms is generally viewed negatively by the surrounding societal group (Gawęcki et al., 2000). Socioeconomic factors, including income, education, occupation, and family structure, have a significant impact on the frequency of purchases and the level of goods consumed. The development of new products and production approaches through technological advancements can alter supply and demand, generating market competition.

The food-related sector is an essential part of the market that is continually evolving due to social, cultural, and demographic changes. Consumer value systems and behaviour are transforming as a result of globalisation, changing lifestyles, frequent travel, and the fading of borders (Grębowiec, 2018; Zabrocki, 2014). Eating behavior encompasses various aspects such as food and dish selection, purchase organization, food storage, planning and preparation for consumption, meal composition, mealtime and location, customary dining partners, and food quality in its broadest interpretation (Goryńska-Goldmann, Ratajczak, 2010; Bigliardia, Galati, 2013).

Paying attention to health and environmental factors is increasingly significant in contemporary societies (Żakowska-Biemas, 2011; Didkowska et al., 2017). This factor deeply impacts consumer perception and food choices. The choice of food for consumption is predominantly concerned with its beneficial effects on human health, as evidenced by various studies (Błaszczak, Grześkiewicz, 2014; Bryla, 2018; Fabisiak, Grochowicz, 2018; Kołodziejczyk, Wojciechowski, 2020). It is also essential to choose products that are free of chemical contaminants and synthetic additives, according to Hermaniuk (2018) and Gadomska et al. (2014). For instance, environmentally conscious individuals might be more prone to purchase eco-friendly products (Wiśniewska, 2022).

The introduction of non-traditional foods has sparked controversy and scepticism among certain consumer groups (Barska, 2018). The fear and anxiety associated with new foods can prevent consumers from acquiring knowledge and experiencing these new products (Socha et al., 2009; Platta, 2019; Siddiqui et al., 2022). As a consequence, a reduced variety of products purchased reduces the demand for new foods in the market (Kozioł-Kozakowska, Piórecka, 2013).

Identifying trends in the consumption of organic, functional, and GMO foods constitutes a crucial matter for fulfilling the nutritional requirements of present and future generations. Although studies on the topic are available in literature, they mainly pertain to organic food. The articles cited contend that a disparity exists between the professed favourable attitudes and the actual purchasing behaviour of consumers towards organic produce (which they only buy in small volumes) (Buder et al., 2014; Caniëls et al., 2021; Paladino, Ng, 2013; Young et al., 2010). In the context of consumer willingness to purchase foods (including organic, functional and GM foods), elements such as convenience of purchase and use, degree of satisfaction of a perceived need, their quality, performance, sustainability and trust in the provider and its offer are also not without importance (Lewicka-Strzałecka, 2015). Given that consumers may differ

in their attitudes towards organic, functional and GM foods, which may be due to different awareness of the realisation of nutritional needs, lifestyle and socio-demographic variables, research in this area is warranted.

2. Research methodology

The main objective of the research was to identify the factors, including gender and generation, which affect the decision-making process of purchasing and consuming organic, functional, and GMO foods.

The empirical research was carried out using the survey method. The research instrument was a survey questionnaire. The survey was conducted in an indirect form using the CAWI method (Google forms). The survey was conducted in spring 2023 among a group of 194 respondents in Gdynia, Sopot and Gdańsk in the Pomeranian Voivodeship (Northern Poland). A snawball sampling technique was used to select the respondent for the survey sample. A total of 109 females (56.19%) and 85 males (43.81%), aged between 19 and 59, participated in the study. The study sample was primarily composed of individuals from Generation X, with 52.94% of men and 58.72% of women. Secondary education (40.37%) and higher education (38.53%) were the dominant educational levels among women, while men's education was distributed evenly. Participants provided informed and voluntary consent to take part in the study. The participants affirmed their knowledge of potential hazards in employing the CAWI method for interviews. he characteristics of the study sample are presented in Table 1.

Table 1.
Study sample characteristics

Parameters	Percentage [%]	
	Male	**Female**
Gender	43.81	56.19
Generation		
Z	24.71	24.77
Y	22.35	16.51
X	52.94	58.72
Education		
Primary or vocational education	32.94	21.10
Secondary	34.12	40.37
Higher	32.94	38.53

Source: own elaboration based on survey results.

The interview questionnaire consisted of thematic blocks including scales on: subjective self-assessment of health and diet, attitudes towards organic food, functional food, GMOs and health and health values of food.

Respondents answering the questions: 1. "How would you rate your health?" could indicate 1 of 5 answers: very bad, bad, neither bad nor good, good, very good; 2. "How would you rate your diet?" could indicate 1 of 5 answers: definitely correct, rather correct, sometimes correct and sometimes incorrect, rather incorrect, incorrect.

The study used quasi-standardised interview questionnaires to assess respondents' attitudes towards organic, functional and GMO foods (Roininen, Tuorila, 1999). Each respondent stated his or her attitude towards the statements on scales according to a 5-point scale with boundary marks "strongly disagree" to "strongly agree", which were assigned a logical number of points reflecting increasing intensity of the attribute when the results were compiled (Ritchey et al., 2003). All possible answers are: strongly disagree - 1 point, rather disagree - 2 points, neither disagree nor agree - 3 points, rather agree - 4 points, strongly agree - 5 points. On the basis of the average value of the sum of points, 3 categories of attitudes towards organic food, functional food and GMO were determined to describe the surveyed group of respondents. 1/3 and 2/3 of the mean score values were used as a criterion for division: negative attitudes (<1/3 of the range), ambivalent attitudes (1/3 to 2/3 of the range) and positive attitudes (> 2/3 of the range).

Respondents' attitudes towards organic food were assessed by answering 6 statements: 1) I don't eat processed foods because I don't know what's in them; 2) I try to avoid products with additives; 3) I would like to eat only organic food; 4) Palatability additives are harmful; 5) Organic food is no better for health than conventional food; 6) I do not pay attention to the additives in the products I eat every day. In accordance with the methodology, reverse scoring was applied to 2 (out of 6) statements made: 5, 6.

Respondents' attitudes towards functional foods were assessed based on their responses to 8 statements: 1 I eat functional foods for health reasons; 2) It's great that modern technology is enabling the development of functional foods; 3) Functional foods are completely unnecessary; 4) Functional foods improve my well-being; 5) Functional foods are a total scandal; 6) Functional foods are useless; 7) Functional foods support a healthy lifestyle; 8) Healthy people should not eat functional foods. In line with the methodology, reverse scoring was applied to 4 (out of 8) statements made: 3, 5, 6, 8.

Respondents' attitudes towards GMO foods were assessed by answering 6 statements: 1) GM food production will be the answer to world hunger; 2) I don't trust modified foods because I don't know what the health effects of eating them might be; 3) I trust GM food because it is controlled at every stage of production; 4) Eating GM food is good for health; 5) I am afraid of GM food because I don't know what it contains; 6) Genetic modification makes it possible to increase the nutritional value of products, with beneficial effects on health. In accordance with the methodology, reverse scoring was applied to 2 (out of 6) statements made: 2, 5.

Respondents' attitudes towards the health and health values of food were assessed using the General Health Interest (GHI) scale (Roininen, Tuorila, 1999). The GHI scale consists of 8. statements: 1) I am very particular about the healthiness of food I eat; 2) I always follow a healthy and balanced diet; 3) It is important for me that my diet is low in fat; 4) It is important

for me that my daily diet contains a lot of vitamins and minerals; 5) I eat what I like and I do not worry much about the healthiness of food; 6) The healthiness of food makes no difference to me; 7) The healthiness of snacks makes no difference to me; 8) I do not avoid foods, even if they may raise my cholesterol. In line with the methodology, reverse scoring was applied to 4 (out of 8) statements made: 5, 6, 7 and 8.

The questionnaire included questions that addressed the sociodemographic characteristics of the respondent, including: gender, age and education level.

When formulating the final conclusions and discussing the results of the study, the factors of gender (male and female) and age (belonging to generations X, Y and Z) were taken into account as differentiating features among the group of respondents under study. Accordingly, the empirical data collected underwent statistical analysis, utilizing Statistica 13.3 (Tibco, Krakow, Poland). The results of this analysis were subsequently presented via the percentage distribution of individual assessments. T he chi-square test with Yates correction was used to determine the influence of gender and age on health status, diet and respondents' attitudes towards organic food, functional food, GMOs and health and health values of food. For all analyses, significance was set at $p \leq 0.05$.

3. Results and discussion

3.1. Subjective self-assessment of health and diet

The respondents' health status and diet were assessed by gender and age group of the respondents (generation Z, Y, X). Significant differences ($p \leq 0.05$) were observed for both health ($p < 0.01$) and diet ($p < 0.01$) across age groups. In contrast, men and women did not differ significantly in their assessment of health status ($p = 0.54$), but did differ significantly in their assessment of diet ($p = 0.05$) (Table 2).

The highest proportions of men and women rating their health as very good and good were in the oldest age group (Generation X), 11.93 and 13.76% of men and 21.10 and 14.68% of women respectively (Table 2). Generation Y was dominated by those who rated their health as good (13.51% of men and 18.91% of women) and 'neither fair nor poor' (13.51% of men and 10.81% of women). In contrast, Generation Z respondents were most likely to rate their health as 'neither fair nor poor' (14.58% of men and 31.25% of women) (Table 2).

Significant differences were observed in respondents' subjective self-assessment of their diet, both between men and women ($p = 0.05$) and within age groups ($p < 0.01$) (Table 3).

Table 2.
Subjective self-perceived health status

Health status	Gender	Percentage [%]		*p*
		Male	Female	
very good	X	11.93	21.10	**<0.01*** 0.54**
good		13.76	14.68	
neither bad nor good		4.59	11.02	
bad		5.50	2.75	
very bad		5.50	9.17	
very good	Y	10.81	5.41	
good		13.51	18.91	
neither bad nor good		13.51	10.81	
bad		8.11	8.11	
very bad		5.41	5.41	
very good	Z	8.33	4.17	
good		6.25	12.51	
neither bad nor good		14.58	31.25	
bad		6.25	6.25	
very bad		8.33	2.08	

Explanatory notes: *Chi2 health status v generation; **Chi2 health status v gender.

Source: own elaboration based on survey results.

Table 3.
Subjective self-perceived of diet

Diet	Gender	Percentage [%]		*p*
		Male	Female	
Incorrect	X	6.42	9.17	**<0.01*** **0.05****
Rather incorrect		7.34	5.50	
Sometimes correct and sometimes incorrect		4.59	13.76	
Rather correct		14.68	11.01	
Definitely correct		8.26	19.27	
Incorrect	Y	5.41	5.41	
Rather incorrect		10.81	5.41	
Sometimes correct and sometimes incorrect		18.91	18.91	
Rather correct		10.81	10.81	
Definitely correct		5.41	8.11	
Incorrect	Z	8.33	4.17	
Rather incorrect		10.42	12.50	
Sometimes correct and sometimes incorrect		14.58	31.25	
Rather correct		8.33	4.17	
Definitely correct		2.08	4.17	

Explanatory notes: *Chi2 health status v generation; **Chi2 health status v gender.

Source: own elaboration based on survey results.

In Generation X, the highest percentage of respondents described their diet as "rather correct" and "definitely correct" (14.68 and 8.26%, respectively, and 11.01 and 19.27%, men and women, respectively). In generations Y and Z, the largest proportions of respondents, both men and women, described their diet as 'sometimes correct and sometimes incorrect' (18.91 and 14.58% and 18.91 and 31.25%, respectively) (Table 3).

3.2. Assessing attitudes to organic food

The modern consumer is conscious of what he or she buys. The quality and composition of a product are the most important factors influencing their decisions. Consumers are increasingly abandoning the consumption of traditional foods in favour of organic products (Kułyk, Dubicki, 2019).

Significant differences in attitudes towards organic food were observed both by gender and by age of the respondent group. It is noteworthy that only in Generation X there was a predominance of people with a positive attitude towards organic products (22.02% of men and 38.53% of women) and no people with a negative attitude. In generations Y and Z, most people had an ambivalent attitude. On the other hand, women of all ages did not express a negative attitude towards this food group (Table 4). Consumer interest in organic food is part of new trends in food market behaviour. EU legislation on organic food sets out the criteria for awarding quality labels and product certification, and provides the basis for shaping the economic benefits of organic food production (Kułyk, Dubicki, 2019).

Table 4.
Attitudes to organic food

Attitudes	Generation	Percentage [%]		*p*
		Male	Female	
positive	X	22.02	38.53	**<0.01*** **0.04****
ambivalent		19.27	20.18	
negative		0.00	0.00	
positive	Y	16.22	24.32	
ambivalent		32.43	24.32	
negative		2.71	0.00	
positive	Z	10.42	18.75	
ambivalent		31.25	37.50	
negative		2.08	0.00	

Explanatory notes: *Chi2 attitudes to organic food v generation; **Chi2 attitudes to organic food v gender.

Source: own elaboration based on survey results.

Significant generational differences were observed for most of the reported attitudes towards organic food (Table 5). Only the perception that the consumption of organic food has no more beneficial effects on human health than conventional food ($p = 0.19$) and the attention paid by consumers to additives in the products they eat every day ($p = 0.28$) did not differ (Table 5).

Table 5.
Respondents' responses to organic products attitude scale statements

Scale statements	Gender [% indications]			*p*
	X	Y	Z	
I don't eat processed foods because I don't know what's in them				
Strongly disagree	7.22	4.12	6.19	
Rather disagree	8.77	3.09	7.73	
Neither disagree nor agree	10.82	2.58	1.04	**0.02**
Rather agree	12.89	4.12	6.70	
Strongly agree	16.49	5.15	3.09	
I try to avoid products with additives				
Strongly disagree	4.12	3.09	5.15	
Rather disagree	6.19	2.58	5.15	
Neither disagree nor agree	9.79	3.61	3.09	**0.01**
Rather agree	23.20	9.28	7.22	
Strongly agree	12.89	0.52	4.12	
I would like to eat only organic food				
Strongly disagree	4.12	3.61	5.67	
Rather disagree	3.61	1.04	3.61	
Neither disagree nor agree	10.82	5.15	5.67	**0.02**
Rather agree	20.10	6.70	5.67	
Strongly agree	17.53	2.58	4.12	
Palatability additives are harmful				
Strongly disagree	1.55	1.55	3.61	
Rather disagree	9.79	5.15	5.15	
Neither disagree nor agree	13.41	4.12	6.71	**0.05**
Rather agree	16.49	6.70	5.15	
Strongly agree	14.95	1.55	4.12	
Organic food is no better for your health than conventional food				
Strongly disagree	14.43	2.06	4.64	
Rather disagree	18.04	6.70	7.73	
Neither disagree nor agree	14.95	4.64	7.22	0.19
Rather agree	4.64	3.09	4.64	
Strongly agree	4.12	2.58	0.52	
I do not pay attention to the additives in the products I eat every day				
Strongly disagree	12.88	3.61	7.22	
Rather disagree	20.10	4.64	4.63	
Neither disagree nor agree	11.34	5.66	6.19	0.28
Rather agree	8.25	3.61	6.19	
Strongly agree	3.61	1.55	0.52	

Explanatory notes: *Chi2 attitudes to organic food v generation.

Source: own elaboration based on survey results.

Analysing the responses to the individual questions, it is clear that Generation X is not only characterised by a positive attitude, but also by nutritional knowledge. In the answers given by Generation X to the questions "I try to avoid products with additives", " Palatability additives are harmful " or "I would like to eat only organic food", the predominant responses were "I rather agree" and "I strongly agree", while no such variation between responses was observed in the other generations (Table 5). Studies by other authors confirms health consciousness, consumer knowledge, perceived or subjective norms, and perception of price influence consumers' attitudes toward buying organic foods. Availability is another factor that affected the purchase intentions of consumers. Age, education, and income are demographic factors that also impact consumers' buying behavior (Gundala, Singh, 2021; Hermaniuk, 2018).

3.3. Assessing attitudes to functional foods

The consumption of functional products can significantly reduce the incidence of many diseases, hence the dynamic development of this food sector (Makała, 2019). However, according to the literature, the majority of consumers have negative attitudes towards functional foods in terms of the nutritional enrichment of products, and positive attitudes towards these foods due to the elimination of substances harmful to human health from products (Gutkowska, Czarnecki, 2020).

The research papers showed that several factors, including socio-demographic, cognitive and attitudinal ones, seem to be serve as the basis for the acceptance of functional products (Topolska et al., 2021). Significant differences ($p < 0.01$) were observed in attitudes to functional foods according to the generation of respondents. However, the groups did not differ significantly by gender ($p = 0.09$). It is noteworthy that, in all groups, indifferent attitudes predominated among men (24.77% for X; 37.84% for Y and 27.08% for Z), whereas among women, with the exception of Generation X, positive attitudes towards functional foods predominated (24.32% for Y and 31.25% for Z) (Table 6).

Table 6.
Attitudes to functional foods

Attitudes	Gender	Percentage [%]		*p*
		Male	Female	
positive	X	15.60	23.85	**<0.01*** 0.09**
ambivalent		24.77	28.44	
negative		0.92	6.42	
positive	Y	13.51	24.32	
ambivalent		37.84	21.62	
negative		0.00	2.71	
positive	Z	16.67	31.25	
ambivalent		27.08	22.92	
negative		0.00	2.08	

Explanatory notes: *Chi2 attitudes to functional foods v generation; **Chi2 attitudes to functional foods v gender.
Source: own elaboration based on survey results.

When assessing attitudes towards functional foods, generations X, Y and Z differed significantly in their responses to the statements: "Functional foods are completely unnecessary" ($p = 0.02$), "Functional foods are a total scandal" ($p < 0.01$), "Functional foods are useless" ($p < 0.01$) and "Healthy people should not eat functional foods" ($p = 0.03$) (Table 7).

Table 7.
Respondents' responses to functional food attitude scale statements

Scale statements	Gender [%indications]			
	X	Y	Z	*p*
I eat functional foods for health reasons				
Strongly disagree	8.25	3.61	4.64	0.95
Rather disagree	9.28	2.07	5.15	
Neither disagree nor agree	13.92	5.15	5.67	
Rather agree	13.40	4.12	5.67	
Strongly agree	11.34	4.12	3.61	
It's great that modern technology is enabling the development of functional foods				
Strongly disagree	7.73	2.06	2.06	0.97
Rather disagree	10.31	3.61	5.67	
Neither disagree nor agree	15.98	5.15	6.70	
Rather agree	15.98	5.67	6.19	
Strongly agree	6.19	2.58	4.12	
Functional foods are completely unnecessary				
Strongly disagree	6.70	1.03	4.12	**0.02**
Rather disagree	10.82	3.62	9.28	
Neither disagree nor agree	18.56	6.70	7.73	
Rather agree	12.37	6.70	1.55	
Strongly agree	7.73	1.03	2.06	
Functional foods improve my well-being				
Strongly disagree	5.15	1.55	2.58	0.29
Rather disagree	13.92	4.64	3.09	
Neither disagree nor agree	20.09	6.19	11.34	
Rather agree	10.82	6.19	4.12	
Strongly agree	6.19	0.52	3.61	
Functional foods are a total scandal				
Strongly disagree	6.19	2.06	8.25	**<0.01**
Rather disagree	14.94	2.06	6.70	
Neither disagree nor agree	18.04	9.28	7.22	
Rather agree	9.79	4.64	1.55	
Strongly agree	7.22	1.03	1.03	
Functional foods are useless				
Strongly disagree	7.22	1.55	9.78	**<0.01**
Rather disagree	11.86	3.09	3.61	
Neither disagree nor agree	19.58	9.28	8.25	
Rather agree	10.31	4.12	2.58	
Strongly agree	7.22	1.03	0.52	
Functional foods support a healthy lifestyle				
Strongly disagree	6.70	2.06	3.10	0.89
Rather disagree	9.79	2.58	3.10	
Neither disagree nor agree	15.98	6.70	8.76	
Rather agree	17.01	5.15	5.15	
Strongly agree	6.70	2.58	4.64	
Healthy people should not eat functional foods				
Strongly disagree	4.64	1.03	4.64	**0.03**
Rather disagree	11.34	2.06	6.70	
Neither disagree nor agree	20.62	7.73	9.79	
Rather agree	11.86	6.70	2.58	
Strongly agree	7.73	1.55	1.03	

Explanatory notes: *Chi2 attitudes to functional foods v generation.

Source: own elaboration based on survey results.

All groups were dominated by responses reflecting ambivalent attitudes ('neither agree nor disagree') towards these types of products (Table 7). Gutkowska and Czarnecki (2020) showed that when choosing these functional foods, consumers pay attention to well-formulated marketing messages that take into account the health-promoting properties of the products, supported by legal regulations that increase consumer trust in food producers. Adequate knowledge and evidence-based communication seem to be the most promising ways to increase consumers' interest in these kinds of products (Topolska et al., 2021).

3.4. Assessing attitudes to GM foods

Respondents' attitudes to GMO food differed significantly between generations X, Y and Z ($p < 0.01$), while no significant differences were observed according to respondents' gender ($p = 0.09$). All groups were dominated by those with ambivalent attitudes (in Generation X: 24.77% of men and 36.70% of women; in Generation Y: 21.62% of men and 35.13% of women; in Generation Z: 29.16% of men and 50.00% of women) (Table 8).

Table 8.
Attitudes to GMO food

Attitudes	Generation	Percentage [%]		*p*
		Male	Female	
positive	X	3.67	5.50	**<0.01*** 0.09**
ambivalent		24.77	36.70	
negative		12.84	16.52	
positive	Y	18.92	5.41	
ambivalent		21.62	35.13	
negative		10.81	8.11	
positive	Z	10.42	4.17	
ambivalent		29.16	50.00	
negative		4.17	2.08	

Explanatory notes: *Chi2 attitudes to GMO food v generation; **Chi2 attitudes to GMO food v gender.

Source: own elaboration based on survey results.

Science is constantly evolving, leading to both positive and negative developments in public health and the environment. One result of scientific progress is the introduction of foods based on genetically modified organisms, the effects of which on human health are still poorly studied and inconclusive (Gutorova et al., 2018). It was shown that generations X, Y, Z differed significantly in their responses to the statements: "GM food production will be the answer to world hunger" ($p = 0.03$), "Eating GM food is good for health" (p=0.01), "I am afraid of GM food because I don't know what it contains" ($p < 0.01$) (Table 9).

Table 9.
Respondents' responses to GMO food attitude scale statements

Scale statements	Gender [%indications]			*p*
	X	Y	Z	
GM food production will be the answer to world hunger				
Strongly disagree	17.53	3.61	2.58	**0.03**
Rather disagree	16.49	5.15	5.67	
Neither disagree nor agree	13.40	5.67	10.32	
Rather agree	3.09	1.55	4.12	
Strongly agree	5.67	3.09	2.06	
I don't trust modified foods because I don't know what the health effects of eating them might be				
Strongly disagree	5.15	4.12	3.61	0.17
Rather disagree	5.67	2.06	5.67	
Neither disagree nor agree	9.79	2.06	4.64	
Rather agree	16.49	6.19	6.19	
Strongly agree	19.08	4.64	4.64	
I trust GM food because it is controlled at every stage of production				
Strongly disagree	20.62	4.12	5.15	0.41
Rather disagree	15.46	6.19	8.77	
Neither disagree nor agree	11.34	4.12	6.19	
Rather agree	4.64	1.55	3.09	
Strongly agree	4.12	3.09	1.55	
Eating GM food is good for health				
Strongly disagree	20.10	4.64	4.12	**0.01**
Rather disagree	14.95	5.15	7.73	
Neither disagree nor agree	11.34	3.09	10.83	
Rather agree	5.67	2.58	1.55	
Strongly agree	4.12	3.61	0.52	
I am afraid of GM food because I don't know what it contains				
Strongly disagree	5.15	2.06	3.63	**<0.01**
Rather disagree	1.03	3.09	5.15	
Neither disagree nor agree	9.79	4.12	5.67	
Rather agree	18.56	4.64	4.64	
Strongly agree	21.65	5.15	5.67	
Genetic modification makes it possible to increase the nutritional value of products, with beneficial effects on health				
Strongly disagree	19.59	5.15	3.09	0.12
Rather disagree	13.40	4.64	7.73	
Neither disagree nor agree	14.43	6.70	11.35	
Rather agree	4.12	1.03	1.55	
Strongly agree	4.64	1.55	1.03	

Explanatory notes: *Chi2 attitudes attitudes to GMO food v generation.

Source: own elaboration based on survey results.

In recent years, many studies have been conducted on public perception of functional foods and genetically modified foods. The results of these studies show that consumers are not very confident about consuming these types of foods because they have little knowledge about them. In addition, they fear that controls on new foods are not carried out reliably or that they are cheated by producers (Klimczuk-Kochańska, 2017). According to the literature on the subject, consumers expressed the greatest concerns about GMO foods, which are produced by manipulating the genetic material of plants or animals. Consumers do not consider GMO foods as a safe type of food and have a very low level of knowledge about GMO products (Szyba, Iwaszczuk, 2019). Studies by other authors These findings indicate a need to clarify guideline

recommendations for health-related risks associated with foods derived from biotechnology (Pakseresht et al., 2021).

3.5. Assessing health attitudes and food health value

Significant differences were observed in the respondents' attitudes towards the health and health values of food by generations X, Y, Z (p = 0.01), while the groups did not differ significantly by gender (p = 0.32). Among Generation X, both positive (20.18% of men and 31.19% of women) and ambivalent (19.27% of men and 27.53% of women) attitudes towards health and the health value of food were found. Ambivalent attitudes predominated in generations Y and Z (in generation Y 43.24% of men and 37.84% of women; in Generation Z 29.17% of men and 35.42% of women) (Table 10).

Table 10.
Attitudes towards health and the health value of food

Attitudes	Generation	Percentage [%]		*p*
		Male	Female	
positive	X	20.18	31.19	**0.01*** 0.32**
ambivalent		19.27	27.53	
negative		1.83	0.00	
positive	Y	8.11	10.81	
ambivalent		43.24	37.84	
negative		0.00	0.00	
positive	Z	12.50	18.75	
ambivalent		29.17	35.42	
negative		2.08	2.08	

Explanatory notes: *Chi2 attitudes towards health and the health value of food v generation; **Chi2 attitudes towards health and the health value of food v gender.

Source: own elaboration based on survey results.

When assessing attitudes to General Health Interest scale statements, generations X, Y and Z differed significantly in the frequency of responses to the statements: "I am very particular about the healthiness of food I eat" (p = 0.02), "I always follow a healthy and balanced diet" (p = 0.03), "It is important for me that my diet is low in fat" (p < 0.01) (Table 11).

Table 11.
Respondents' responses to General Health Interest scale statements

Scale statements	Gender [%indications]			*p*
	X	Y	Z	
I am very particular about the healthiness of food I eat				
Strongly disagree	3.09	2.06	1.55	**0.02**
Rather disagree	6.19	3.09	8.25	
Neither disagree nor agree	10.32	5.15	5.67	
Rather agree	16.49	4.12	6.19	
Strongly agree	20.10	4.64	3.09	

Cont. table 11.

I always follow a healthy and balanced diet				
Strongly disagree	6.19	1.03	2.06	
Rather disagree	8.25	6.19	7.22	
Neither disagree nor agree	11.86	2.58	6.70	**0.03**
Rather agree	15.96	7.73	5.67	
Strongly agree	13.92	1.55	3.09	
It is important for me that my diet is low in fat				
Strongly disagree	2.09	2.58	4.12	
Rather disagree	5.68	4.12	9.77	
Neither disagree nor agree	17.53	6.17	4.64	**<0.01**
Rather agree	17.53	4.64	4.12	
Strongly agree	13.40	1.55	2.06	
It is important for me that my daily diet contains a lot of vitamins and minerals				
Strongly disagree	1.03	2.06	1.03	
Rather disagree	8.78	3.09	6.70	
Neither disagree nor agree	8.25	4.12	5.15	0.12
Rather agree	21.65	7.22	6.70	
Strongly agree	16.49	2.58	5.15	
I eat what I like and I do not worry much about the healthiness of food				
Strongly disagree	8.76	2.58	2.58	
Rather disagree	14.43	4.63	6.19	
Neither disagree nor agree	14.95	3.61	6.19	0.86
Rather agree	11.86	6.70	6.70	
Strongly agree	6.19	1.55	3.08	
The healthiness of food makes no difference to me				
Strongly disagree	12.89	2.08	3.09	
Rather disagree	14.95	5.15	6.70	
Neither disagree nor agree	11.34	4.12	5.15	0.62
Rather agree	11.86	4.12	5.67	
Strongly agree	5.15	3.61	4.12	
The healthiness of snacks makes no difference to me				
Strongly disagree	9.79	3.61	5.15	
Rather disagree	15.46	3.09	3.61	
Neither disagree nor agree	12.37	5.15	6.70	0.42
Rather agree	13.43	3.09	6.19	
Strongly agree	5.15	4.12	3.09	
I do not avoid foods, even if they may raise my cholesterol				
Strongly disagree	11.86	1.55	4.12	
Rather disagree	17.01	3.09	5.15	
Neither disagree nor agree	12.38	6.70	6.70	0.11
Rather agree	11.86	5.15	4.64	
Strongly agree	3.09	2.58	4.12	

Explanatory notes: *Chi2 attitudes towards health and the health value of food v generation.

Source: own elaboration based on survey results.

4. Conclusion and future perspectives

Perceptions of different types of food have been an issue for years and opinions are very divided, making it difficult to make food choices and maintain a healthy lifestyle. Food knowledge allows consumers to broaden their choices and provides opportunities to try

new foods. The assessment of respondents' attitudes towards different types of food: organic, functional and GMO foods, as well as health and health values of food, showed mostly ambivalent attitudes of respondents in the subject studied. No negative attitudes towards organic food were found among the group of women surveyed. The most frequently chosen response by the respondents to the statements in the scales presented in the study was "neither disagree nor agree". The second most frequent responses were: "rather disagree" and "rather agree". This indicates a high level of uncertainty among respondents about their answers.

The statements: "I try to avoid products with additives", "I would like to eat only organic food", " Palatability additives are harmful " were influential in shaping respondents' positive attitudes towards organic food. It was also shown that the statements " I eat functional foods for health reasons " and "Functional foods support a healthy lifestyle" influenced the occurrence of positive attitudes towards functional foods in the sample group of women and men. It was shown that the statement: " I don't trust modified foods because I don't know what the health effects of eating them might be" best described the attitudes of the male group surveyed towards GMO foods. Among women, the statement with the highest average score was: "GM food production will be the answer to world hunger ". The statements: " I am very particular about the healthiness of food I eat " and " It is important for me that my daily diet contains a lot of vitamins and minerals" were influential in the emergence of positive attitudes towards health and the health values of food among the respondents.

The authors believe that research into consumer perceptions of different food types should continue, as the results of the pilot study indicate that respondents' knowledge of the nutritional value and safety of organic, functional and GMO products is very low. Changing respondents' attitudes from ambivalent to positive towards organic and functional foods will lead to an expansion of the range of foods consumed and minimise the risk of developing non-communicable diseases, including metabolic and cardiovascular diseases.

This study analyses the attitudes of consumers (Generation X, Y, Z) towards organic, functional and GMO foods and their concerns about the health and health values of food, and the results can be used as a basis for discussion and consideration of the development of intelligent food systems using information and communication technologies (ICT). These systems will provide consumers (Generations X, Y, Z) with knowledge about the range and quality of organic, functional and GMO foods and help to meet the nutritional needs of societies. In view of the challenges of the Sustainable Development Goals, it is useful and legitimate to carry out research to monitor the eating habits of different population groups in order to diagnose the need for hedonistic measures that are linked, among other things, to the issue of ensuring health and taking greater care of the mental and physical condition of current and future generations. The research conducted is part of health risk management and health promotion in the Polish population.

The research carried out has certain limitations. The identification of factors influencing the attitudes of consumers belonging to generations X, Y, Z towards organic, functional and GMO food, as well as the health and health values of food, was carried out using a snapshot sample of the inhabitants of Gdynia. The results of the survey are therefore not representative of the entire Polish population and should be interpreted with caution.

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