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Perceived determinants of food purchasing behavior applicable for behavioral change toward sustainable consumption

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The paper deals with consumer behavior in the context of sustainable development of society. A questionnaire survey of 732 respondents was used to understand the determinants of food purchasing behavior toward sustainable consumption. The paper identifies the factors that the consumer determines in food purchasing as critical in terms of sustainable consumption and requiring behavioral change toward sustainability in terms of healthy lifestyle, reduction of food wastage, and conscious consumption. Respondents commented on 22 factors and the quantification of their impact on food waste and expressed the strength of opinion on sustainability issues. To evaluate the collected data, PCA factor analysis was used, which defines the importance of each factor by identifying artificial hypothetical variables, which are "Sustainability" and targeted education as appropriate tools for it, "Food usability," which is a recommendation to producers by food quality, offering new types of food with longer shelf life, as well as "Pricing," "Quality" and "Convenience." The authors also sought to understand what measures they take in relation to waste and how they behave toward sustainable consumption and environmental protection. They created 14 content questions on this topic and by using factor analysis, 3 hypothetical variables were created, namely "Sustainable behavior" which expresses a healthy lifestyle, "Thoughtful purchase" which expresses a relationship with environmental protection before purchasing and "Zero waste" which means that the household tries to make additional use of food. Thus, it seeks a use for the food it cannot consume at a given time and creates a supply for other consumers. This behavior is a good prerequisite for achieving a change in consumption behavior. The influence of selected sociodemographic indicators on the frequency of wastage was also investigated using the χ^2 -squared test. The influence of generation and number of children in the household on the frequency of wastage was demonstrated. The results of the analyses on the importance of individual factors and consumer behavior, especially of the young generation, argue for education on sustainable consumption.

KEYWORDS

sustainable consumption, food waste, consumer behavior change, frequency of food waste, households food waste

Introduction

In addition to the scientific debate, sustainable consumption became a political debate in 1992 at the Earth Summit in Rio de Janeiro. In the decade that followed, several institutional programs were launched focusing primarily on sustainable production but also sustainable consumption. Sustainable consumption means consuming differently, consuming responsibly, or consuming less. The concept of sustainable consumption was defined in 1994 at the Oslo meeting and includes the essentials, i.e., that “*sustainable consumption is mainly related to meeting needs, improving quality of life, increasing the use of renewable energy sources and minimizing waste and emissions*” (Šajin, 2020). Purvis et al. (2019, p. 684) define sustainable consumption as “*the needs of the present without compromising the ability of future generations to meet their own needs.*” The UN has already identified sustainable consumption as one of its pillars and primary goals for achieving environmental sustainability in 2010 (Marrakech Process Secretariat: UNDESA and UNEP, 2010; Yadav and Pathak, 2016). While government interventions or policy proclamations contained in countries’ strategic goals have implications for sustainability (the so-called top-down approach), a bottom-up approach is also needed to achieve the desired SDGs (sustainable development goals), i.e., that individuals in different roles and with different capabilities are largely responsible for behaviors that affect their current and future well-being and that of future generations (Moschis et al., 2020).

Food production and consumption is one of the biggest sustainability issues, both in production and consumption and is associated with various environmental impacts (Tobler et al., 2011; Berčík and Gálová, 2013). Country strategies need to take into account not only projected changes in people’s diets (eating habits, food waste) but also the entire value chain of food production and consumption options, including food waste. Stakeholder institutions, including education, have a key role to play in changing consumption behavior in favor of healthy eating behavior and healthy lifestyles, especially in stimulating and supporting the proposed changes. Although market demand has a strong influence on the structure and quality of supply, i.e., on food producers, measures outside the agricultural sector are also key for a successful transition to sustainable food production, which is precisely sustainable consumption and education (Morais et al., 2021; Veselá et al., 2023). The key is then to identify the determinants (determinants) through which we can influence consumers so that education for sustainable consumption has the greatest impact. These determinant variables are not well described in the current literature and thus represent a research gap.

Food producers and retailers in the context of sustainable food consumption, therefore, expect the following from the research: to identify the factors that are consumer-determined as critical for sustainable consumption and requiring a change toward sustainable behavior in terms of healthy lifestyles, reducing food waste and conscious consumption, etc. This identification of factors, together with the understanding of consumer behavior in the food market, including the effectiveness of measures to reduce food waste, is what the authors seek to do in the present paper.

Purvis et al. (2019) define three key dimensions of sustainability: environmental sustainability (planet), economic sustainability (profit), and social sustainability (people). These dimensions are interdependent and interact with each other. From an environmental

perspective, according to Southerton et al. (2004), sustainable consumption means using goods and services that meet basic needs and deliver a better quality of life, while minimizing the use of natural resources, toxic materials, and life-cycle emissions of waste and pollutants, with the goal of not compromising the needs of future generations. In economic terms, according to Reisch and Thøgersen (2015), this means that the economy must move away from producing too many unsustainable consumer products and toward producing more sustainable products, services, and infrastructure. The responsible behavior of individual consumers is crucial for sustainable development (Lubowiecki-Vikuk et al., 2021).

Francis and Sarangi (2022) state that sustainable consumption is based on a decision-making process that takes into account the social responsibility of the consumer, which is particularly evident in the younger generation, in addition to individual needs and wants (Su et al., 2019; First Insight and The Baker Retailing Center, 2021; Kiliç et al., 2021; Orea-Giner and Fusté-Forné, 2023). Different studies conclude different determinants of sustainable consumption. Shen et al. (2022), who compared models of the theory of planned behavior using a meta-analytic structural equation modeling approach, concluded that individual consumer attitude has the strongest influence on sustainable food consumption intention, followed by subjective norms and perceived behavioral control.

When we think about sustainability in the context of food consumption, we can look at it from both a supply and a demand perspective. That is, both the sustainability of production and the quantity consumed (Hoogland et al., 2005). The main approach to sustainable consumption is to shape the demand for food (Moschis et al., 2020). Demand for food and non-food agricultural products is increasing as the global population grows. The United Nations median estimate (The United Nations, 2017) is that there will be 9.73 billion people on planet Earth in 2050. Yue et al. (2020) highlight the challenges of not only ensuring food production in quantity for a growing population but at the same time how reconciling sustainable production and sustainable consumption.

The concept of sustainable consumption in the context of food purchasing has gained considerable attention in recent years (Su et al., 2019; Holotová et al., 2021; Liu et al., 2021; Shen et al., 2022). From the consumer side, it is about sustainable product choice and furthermore sustainable dietary patterns (e.g., the amount consumed and the composition of the diet). According to Liu et al. (2021), the trend is to be concerned with the origin of food and the nutritional aspects of food. Reynolds et al. (2019) discuss the issue of food waste, which has become a topic of international concern, with the goal of halving global food waste at the retail and consumer level by 2030. According to Morávková et al. (2022) and Kubičková et al. (2021) findings, households are the main producers of food waste. According to their findings, it follows that households waste more in urban developments than in rural areas. The cause of wastage can be food spoilage caused by buying large quantities of food (Kubičková et al., 2021; Morávková et al., 2022). Wastage and its structure are more related to household consumption patterns (Parfitt et al., 2010). It is in households that wastage can be reduced by a number of external measures such as pack size, buying large quantities of food, buying randomly instead of planned, poor storage, monitoring expiry dates and others (Flanagan and Priyadarshini, 2021; Jungowska et al., 2021). From the above, it is appropriate to examine the factors that influence households in food waste.

Hazuchová et al. (2020) show the importance of the approach to the issue of waste by the individual, or how the issue of waste is perceived by the individual. This knowledge can be used to target appropriate tools to achieve a change in attitudes toward waste and consequently reduced food waste. However, there is no review that addresses the effectiveness of interventions aimed at preventing food waste at the consumption stages. Nevertheless, it is possible to find authors who address this very issue (Kubíčková et al., 2021; Morávková et al., 2022). This important gap, if filled, could help those trying to reduce food waste. Which measures to reduce food waste are effective and efficient is a key issue. There is a range of possible strategies for each area of the food chain, with examples including improved communication on forecasting between retailers and agricultural producers, public information campaigns, skills programs in the home or workplace, and changes in the way food is packaged and sold. Within each of these strategies, there are a number of decisions that need to be made by policymakers and practitioners that can influence the effectiveness of interventions in preventing food waste (Reynolds et al., 2019).

Verain et al. (2015) note that it is important to focus on both the level of sustainable food consumption and the quality of behavior in relation to food waste. Aschemann-Witzel et al. (2019) outline six necessary transformations to which sensory science can contribute. These are (1) promoting a dietary shift toward more sustainable foods and diets, (2) increasing food diversity, (3) reducing food waste, (4) enhancing food system circularity, (5) increasing and prioritizing food-related well-being, and (6) coping with the impacts of climate change. [(1) promotion of a dietary shift toward more sustainable foods and diets, (2) increase of food diversity, (3) food waste reduction, (4) enhancement of the circularity of the food system, (5) heightening and prioritizing food-related well-being, and (6) coping with the effects of climate change]. The popularity of adopting food from organic farming can be improved by raising the profile of these products (Aschemann-Witzel et al., 2019). Yadav and Pathak (2016) highlight the high prices and unavailability of organically grown products as major barriers for consumers to purchase organic food.

Everyday consumption practices are still largely driven by convenience, habit, personal health concerns, hedonism, and individual responses to social and institutional norms, and most importantly, are likely to be resistant to change. Puntiroli et al. (2022) agree with the temporal consistency of sustainable consumer behavior, but address the question of whether current sustainable consumer behavior will be achieved in the future or possibly encourage other types of sustainable behavior. In addition, the last decade has seen the emergence of the ethical consumer, who perceives a more direct link between what they consume and the social problem itself. This kind of consumerism primarily involves environmental issues but is also extending to animal welfare, human rights, and working conditions in the third world. In general, the ethical consumer feels a responsibility toward society and expresses these feelings through their purchasing behavior. Yet price, quality, convenience, and brand recognition are still the most important decision criteria, while ethical factors are only effectively taken into account by a minority of consumers. A recent study by Shen et al. (2022) on purchase intentions for sustainable food also showed that psychosocial variables such as attitudes, beliefs, and subjective norms, more than demographic data, independently predict purchase intention for sustainable products.

In particular, practitioners expect consumer behavior researchers to identify the factors that influence consumer behavior and to be able to predict changes in consumer behavior in advance (Shen et al., 2022). There are different approaches to identifying and classifying factors, and these approaches have undergone major changes in their identification methods over time. According to Hawkins et al. (2003), external and internal factors influence consumer behavior. They consider external factors to be those created by the social environment (culture, values, demographics, social status, reference groups, family, and household) and marketing tools. Internal factors (learning, memory, motives, personality, and emotions) are inherent in the consumer as an individual and influence the perception of a product or service. In the context of these findings, it is useful to further explore the influence of sociodemographic characteristics on food waste. For example, the influence of generation could have an impact. According to Damico et al. (2023), Generation Z shows a high interest in the sustainability of the planet and is most aware of the benefits that sustainability brings. For them, improving knowledge can play a key role in shaping their consumption behavior. But knowledge can also play a key role in the supply side of the market, which influences consumers through marketing tools.

In the opinion of the authors of the paper and in the context of the review of the cited authors, much attention has been paid in recent years to food products from different perspectives. As an example, TPB constructs have been pronounced to explain consumers' intention and purchase behavior toward organic food (Qi and Ploeger, 2019; Aungatichart et al., 2020). At the same time, there are studies where subjective norms had the weakest or no influence on intention and purchase behavior (Rong-Da Liang, 2014; Dorce et al., 2021). Therefore, further research is needed to investigate not only the external factors influencing consumer behavior but also whether and to what extent subjective norms influence consumer buying behavior for different food products. The individual's behavior in fulfilling the intention of sustainable consumption and education toward this behavior, and especially the effectiveness of different intervention modes, are a research gap that needs to be filled.

The authors are guided by the results of the survey to identify the factors that are determined by the consumer as decisive in terms of sustainable consumption and requiring a change toward sustainable behavior in terms of healthy lifestyle, reduction of wasted food and conscious consumption, etc. This identification of factors, together with the understanding of consumer behavior in the food market, including the effectiveness of measures to reduce food waste, is what the authors seek to do in the present paper. In realizing the influence of the individual and his/her perception of sustainable consumption, the influence of socioeconomic indicators should also be observed. It is proposed to test the hypotheses about the congruence or difference of the effect of these indicators on food purchase or waste. The expected results may be useful for food producers and sellers, as well as for institutions and households responsible for educating individuals toward sustainable consumption.

Materials and methods

A questionnaire survey (quota sampling, data collection: February–April 2023, Czech Republic) is used to analyze consumer behavior on food waste in the context of sustainable consumption. The

questionnaire is created in Google Forms and distributed electronically. A total of 732 responses are collected. In the distribution of the questionnaire, care is taken to maintain the representativeness of the core sample primarily in the following characteristics: gender, generation, education, and degree of urbanization, with a 90% reliability. The representativeness is verified according to data from the Czech Statistical Office (CZSO). The characteristics of the research sample can be seen in Table 1 (n =absolute frequency, p =relative frequency).

To characterize age groups, the research sample is divided by generation (Pew Research Center, 2019). Boomers I (birth year 1946–1954, or 68–76 years old); Boomers II (birth year 1955–1964, or 58–67 years old); Generation X (birth year 1965–1980, or 42–57 years old); Millennials (birth year 1981–1996, or 26–41 years old); and Generation Z (birth year 1997–2012, or 10–25 years old). Education is divided into three categories – primary, secondary, and university. To determine the degree of urbanization (village or town), a threshold of 5,000 inhabitants is set.

The questions in the questionnaire are divided into several parts. In the first part, there are questions about waste in the household, such as: how much food surplus is used in your household, how often is food thrown away in your household? Which food is most often thrown away in your household? Respondents are given a choice from a list of food items that are based on previous research (Macková et al., 2019; Hazuchová et al., 2022). Respondents are also asked about the way in which they purchase food. The different variations of the “food shopping patterns” are: (1) Major food purchases once a week or even at longer intervals, with the possibility of supplementing emergency purchases, (2) Major purchases several times a week, without supplementing purchases, (3) Absence of a dominant shopping pattern, (4) I buy food frequently, as needed, but do not stockpile, (5) Food is bought every day. Furthermore, question about the institutions that should be responsible for disseminating information about food waste and questions about the perceived importance of factors in the context of sustainable food consumption and environmental protection, both about the causes of waste and about measures to reduce waste. Respondents comment on a total of 22 factors related to causes of waste and 14 factors related to measures to reduce waste. The strength of their influence is assessed using a 10-point scale, (10 – high influence, 1 – almost no influence). 22 factors related to causes of waste are: *Impulse purchase, Unplanned shopping, Low prices, A purchase influenced by a promotion, No cooking ideas, Too big packaging, Lack of cooking skills, Low quality products, Too much food bought, Unsuitable storage conditions, Too large portions of food, Preparing too much food, Trad. or eco. breeding/cultivation, Type of packaging (recyclable), Regional origin and its support, Degree of processing, Food spoilage, Expires the expiration date, Discount, Price, Taste, Quality*. 14 factors related to measures to reduce waste are: *Buying seasonal products, Buying local products, Limiting meat consumption, Restriction of IPF consumption, I make a list before shopping, I check the expiry date and choose the longest ones, I use the products to prepare other meals, Packaging waste sorting, Reducing food waste, I freeze the food and eat later, I prepare preserves (pasteurization), I feed the animals, I share the excess food with others, I try to buy less*.

The next section asks questions about food prices and waste, and whether the price of food affects the amount of waste. In addition, respondents rate on a 5-point scale the extent to which the extent of food waste is affected before and after food price increases in times of high

TABLE 1 Characteristics of the research sample.

Categories		Questionnaire		CZSO
		n	p [%]	p [%]
Gender	Female	431	58.88	49.29
	Male	301	41.12	50.7
Generation	Generation Z	224	30.60	15.78
	Millennials	174	23.77	20.71
	Generation X	238	32.51	24.15
	Boomers II	41	5.60	11.95
	Boomers I	76	10.38	10.26
Education	Primary	29	3.96	12.5
	Secondary	465	63.52	63.5
	Higher	238	32.51	17.6
Degree of urbanization	City/town	439	59.97	59.88
	Village	293	40.03	40.12
Number of children	0	477	65.16	
	1	156	21.31	
	2	68	9.29	
	3 and more	31	4.23	

Source: own.

inflation. The last part of the questionnaire is devoted to identification questions such as age, gender, education, municipality, etc.

To achieve the formulated research objectives and based on the current knowledge, we formulate the following assumptions:

Assumption 1: There is a relationship between the change in food prices and the extent of its wastage.

Assumption 2: There is a relationship between sociodemographic characteristics and the frequency of wastage.

Assumption 3: There is a relationship between the way households purchase food and the frequency of wastage.

A paired t -test is used to assess the effect of price changes (before and after price increases) of food on the extent of wastage. A χ -squared test is used to assess the effect of socio-demographic characteristics (generation, education, number of children in the household, size of the municipality) on the incidence of wastage. The χ -squared test is also used to assess the effect of purchasing mode on the frequency of wastage.

Questions on the perceived importance of factors in the context of sustainable food consumption and environmental protection, both on the causes of waste and on measures to reduce waste, are developed and evaluated using exploratory factor analysis. This allows the reduction of a large number of factors to a smaller number of artificially created hypothetical variables (components, determinants) that determine consumer behavior. The application of factor analysis allows us to understand which factors are related and fit together. To achieve a specific interpretation, the new hypothetical is named. The calculation began by determining the factor loadings based on the eigenvalue of the principal components analysis (PCA). The components that have an eigenvalue >1 are selected. These components are then referred to as the determinant.

The second stage is the rotation of the factors by the Varimax method, and thus the transformation into interpreted factors. Finally, the factor loadings are calculated (Finch, 2019). The appropriateness of using factor analysis is assessed based on KMO and Bartlett's test of sphericity. The factor loading threshold determining whether a factor contributes significantly to the relevant component (determinant) is 0.6. All statistical evaluation of the data is performed using IBM SPSS Statistic 29.0.0 software (Watkins, 2021; Hague and Harrison, 2022).

Results

A questionnaire survey conducted on 732 respondents in the Czech Republic on the issue of sustainable food consumption and its perception in Czech households showed that most respondents are aware of the importance of food wastage and also waste sorting in relation to the concepts of sustainable consumption. These two factors are perceived by households as crucial factors that can contribute to environmental protection. The desire not to waste is evident from the fact that only 20% of households admit to discarding surplus food, 15% say they do not have surplus food, about 15% give surplus food to the needy, and about 50% of households use it to prepare other meals. The most commonly wasted foods are vegetables, fruit, bakery products, and ready meals. Figure 1 shows that the highest percentage of respondents (47.4%) indicated that they discard bakery products most often, followed by 43.17% of respondents who indicated that they discard ready meals most often. For vegetables and fruits, the reasons for wastage are short shelf life, while for ready meals the reasons for wastage vary (inappropriate quality and taste, large portions). The structure of wasted food helps in selecting appropriate measures to reduce waste.

The price of food can affect the amount of food wasted. When asked to what extent the amount of food waste in the household

depends on the price of food products, more than 95% of the respondents answered that price does not influence waste. But when asked again whether price increases (in times of high inflation and increased food prices) have affected food waste, a different result was reached. Based on our *Assumption 1*, we formulated a hypothesis about the relationship between the price change before and after the food price increase and the amount of food waste, which we then tested using a paired *t*-test.

H0: Change in food prices (before and after inflation) does not depend on the extent of food waste.

The calculated value of the paired *t*-test criterion $t = -10.536$, $p < 0.001$ tells that the change in food prices had a highly significant effect on the frequency of food wastage, in the negative direction.

Respondents also answered their perception of environmental protection in relation to consumer behavior in the context of the currently intensively communicated issue of sustainable consumption. The majority of respondents expressed the view that households can do the most good for the environment by reducing food waste and regularly sorting waste. Waste sorting is perceived by respondents as the most important factor in protecting the environment, and therefore a question is posed to producers and distributors about the need to implement measures that will lead to a reduction in the volume of material used (functionality, packaging design). This is followed by the need to reduce the volume of wasted food, and they also believe that buying seasonal and local products and reducing the consumption of industrially processed food also contribute to environmental protection.

Another assumption was that sociodemographic characteristics may influence the frequency of wastage. As the survey showed, consumer food purchasing behavior is influenced by sociodemographic characteristics that link each individual's motivation to buy with their perceived values. It is the perceived value that largely determines the direction of consumer

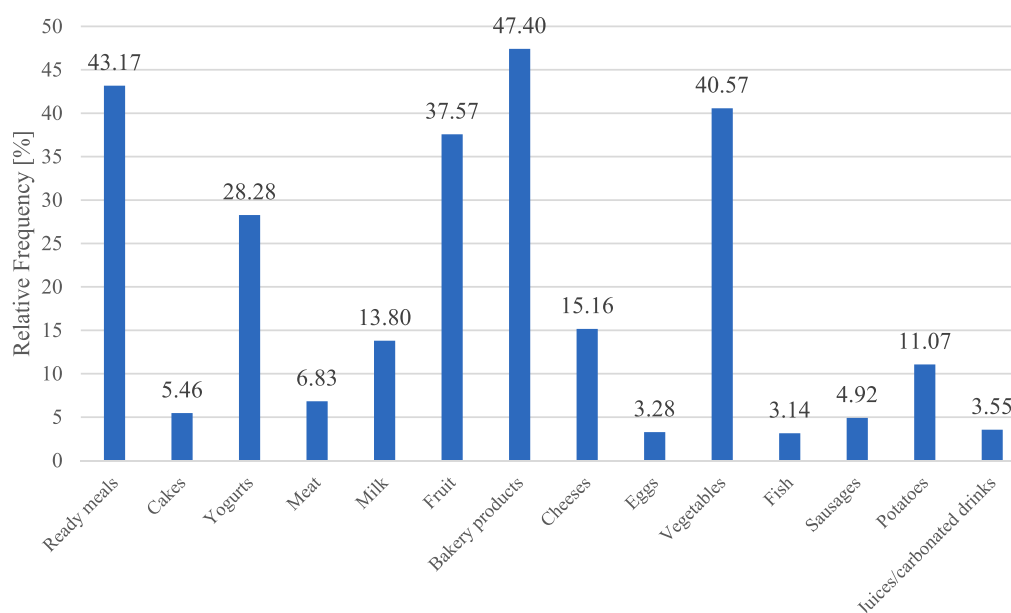


FIGURE 1
Foods that are the most often wasted by households. Source: own processing.

behavior, whether they want to satisfy their consumption first and foremost, or whether they prioritize and are aware of what they have caused by their consumption. What are the values in satisfying a need, whether a healthy lifestyle, a healthy diet, a healthy environment, and its sustainability. From our Assumption 2, we formulated four hypotheses regarding sociodemographic groups, which we then tested.

H0: Generation membership does not depend on the frequency of food waste.

H0: The number of children in the household has no effect on the frequency of food waste.

H0: Educational attainment has no effect on the frequency of food waste.

H0: Size of place of residence has no effect on the frequency of food waste.

These hypotheses were tested by the χ -squared test. The calculated values of the χ -squared test to test the hypotheses expressed about sociodemographic characteristics are shown in Table 2.

The results of the tests to test the null hypotheses showed that generation membership has a demonstrable effect on wastage, as does

TABLE 2 Results of tested sociodemographic characteristics by Chi-square tests.

Characteristics	Pearson χ^2	Value of p
Generation	43.283	< 0.001
Number of children	37.585	< 0.001
Education	9.719	0.151
Degree of urbanization	1.398	0.845

Source: own processing.

the number of children in the household. In contrast, there was no effect of education or size of residence on the frequency of wastage. On the basis of our next/last Assumption 3, we formulated a hypothesis about the relationship between the frequency of wastage and the “mode of shopping,” which was also tested with a χ -squared test.

H0: The mode of food shopping has no effect on the frequency of food wastage.

The Pearson χ -squared = 50.654; $p < 0.001$ means that food shopping methods significantly influence the frequency of food wastage. The forms of grocery shopping undertaken are major grocery shopping once a week or even at a longer interval, with the possibility of supplementing emergency purchases (48.9% of respondents); major grocery shopping several times a week, without supplementing purchases (13.2% of respondents); no dominant mode of shopping (15.8% of respondents); grocery shopping frequently, as needed, but not stocking up (18.1%); and grocery shopping every day (3.9% of respondents). These food shopping patterns show that effective measures to reduce food waste can be identified in all shopping patterns, but by different measures, different for each shopping pattern. This means that it is the mode of purchase that strongly influences attitudes toward waste. These food purchasing patterns show that effective measures to reduce food wastage can be identified in all purchasing patterns but in different forms of intervention.

The issue of food waste in society is of course linked to the need to achieve a reduction in overall food consumption, especially from a global perspective. The different types of interventions to reduce food waste appear to be not very effective according to the respondents. Respondents have a strong opinion on the responsibility of education for conscious consumption and dissemination of information that will lead to a reduction of food waste. The importance respondents attach to each institution is shown in Figure 2.

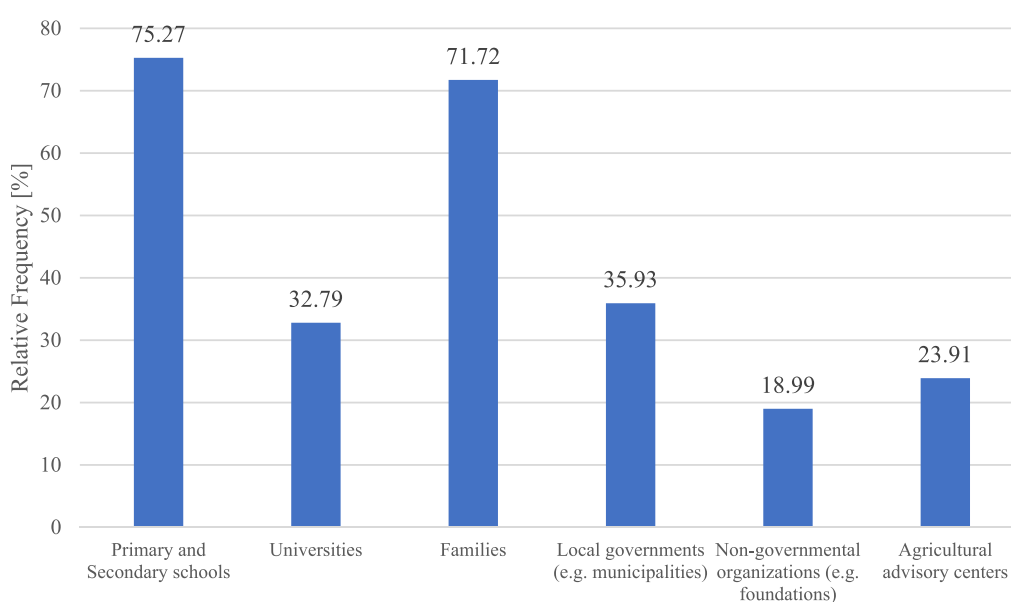


FIGURE 2 Respondents' opinion on the responsibility of institutions. Source: own processing.

According to respondents, primary and secondary schools and parents are clearly given the main responsibility. Among other institutions, universities, local governments, agricultural and extension centers, and other NGOs (non-governmental organizations) can provide some influence and success in education, according to respondents.

The aim of the present paper and the main focus of the investigation was to gain a deeper understanding of the factors that have some influence on food wastage. Respondents commented on a total of 22 factors and rated their strength of influence using a 10-point scale. These are factors that influence food purchasing and subsequently food waste. An example is expected quality, which did not meet the customer’s expectations, similar to taste. The degree and method of food processing, especially industrial processing, also have an impact on waste and can cause waste. Regional origin – its promotion, possibly organic cultivation (farming) – also appears to be important for waste, but in a positive way. Classical factors such as price, discount, and type of packaging are decisive for the purchase of food, as well as the type of purchase (planned/impulsive). On the other hand, after the purchase, factors such as perishable food, expiration date, too much food bought, too large portions of food at home for the purpose, unsuitable storage conditions, lack of cooking skills, lack of effort to process the remaining food, e.g., freezing,

canning, sharing with the needy, etc. are decisive for wastage. Factor analysis was used to determine how these factors are perceived in relation to food waste and which of them has the greatest influence on food waste (Tables 3,4). The prerequisites for the appropriateness of using factor analysis were met with a KMO value of 0.892 (i.e., greater than 0.8) and Bartlett’s Chi-squared test of 7924.45; $p < 0.001$. Table 3, which contains the cumulative percentage of variability from the descending order of the factors, tells us that most of the variability (64.56%) is explained by the newly created 5 hypothetical variables. Table 3 shows that the factors are newly explained by the 5 newly created components (“Convenience,” “Sustainability,” “Food usability,” “Pricing,” and “Quality”) which contain a cumulative percentage of variability of 64.56%. These components are constructed based on Eigenvalue >1 and are in bold.

In Table 4, individual factors are in bold that contribute significantly to the formation of the respective component (factor loadings greater than 0.6). The determinant factor loadings gave rise to the following hypothetical variables that are named in columns in Table 4: “Convenience” (of shopping), “Sustainability,” “Food usability,” “Pricing,” and “Quality.” The Convenience determinant is the only one of the five determinants that contain both factors influencing purchase and factors influencing post-purchase behavior. All of these factors are manifestations of

TABLE 3 Components of the causes of waste.

Component	Initial eigenvalues			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Convenience = 1	7.184	32.656	32.656	6.586	29.934	29.934
Sustainability = 2	2.833	12.875	45.531	2.568	11.674	41.608
Food usability = 3	1.774	8.066	53.597	1.843	8.375	49.984
Pricing = 4	1.388	6.309	59.906	1.623	7.378	57.362
Quality = 5	1.024	4.656	64.562	1.584	7.200	64.562
6	0.901	4.097	68.659			
7	0.757	3.441	72.100			
8	0.684	3.110	75.210			
9	0.630	2.866	78.076			
10	0.612	2.783	80.859			
11	0.555	2.523	83.382			
12	0.457	2.078	85.461			
13	0.440	2.001	87.462			
14	0.424	1.926	89.388			
15	0.391	1.777	91.165			
16	0.380	1.726	92.891			
17	0.324	1.471	94.362			
18	0.307	1.397	95.759			
19	0.277	1.259	97.018			
20	0.266	1.210	98.228			
21	0.236	1.072	99.300			
22	0.154	0.700	100.000			

Total Variance Explained (Extraction Method: PCA). Source: SPSS.

TABLE 4 Rotated component matrix (Extraction method: PCA; Rotation method: Varimax with Kaiser normalization; rotation converged in 6 iterations).

	Hypothetical variables (determinants)				
	1	2	3	4	5
	Convenience	Sustainability	Food usability	Pricing	Quality
<i>Impulse purchase</i>	0.832	-0.015	0.171	-0.013	0.052
<i>Unplanned shopping</i>	0.821	-0.008	0.174	-0.016	0.054
<i>Low prices</i>	0.811	-0.039	0.115	0.145	0.057
<i>A purchase influenced by a promotion</i>	0.797	-0.038	0.085	0.116	0.016
<i>No cooking ideas</i>	0.782	0.144	0.065	-0.036	-0.191
<i>Too big packaging</i>	0.771	0.030	0.184	-0.002	0.020
<i>Lack of cooking skills</i>	0.747	0.164	0.049	-0.035	-0.251
<i>Low quality products</i>	0.673	0.157	-0.072	0.005	0.002
<i>Too much food bought</i>	0.670	-0.062	0.397	-0.109	0.193
<i>Unsuitable storage conditions</i>	0.650	0.140	0.056	0.062	-0.208
<i>Too large portions of food</i>	0.612	-0.068	0.425	-0.098	0.202
<i>Preparing too much food</i>	0.535	-0.093	0.486	-0.076	0.249
<i>Trad. or eco. Breeding/cultivation</i>	0.047	0.837	0.015	-0.003	0.090
<i>Type of packaging (recyclable)</i>	-0.010	0.771	0.135	0.136	-0.125
<i>Regional origin and its support</i>	0.088	0.762	-0.098	-0.123	0.199
<i>Degree of processing</i>	0.160	0.558	-0.026	-0.015	0.358
<i>Food spoilage</i>	0.074	0.000	0.792	0.153	-0.054
<i>Expires the expiration date</i>	0.320	0.119	0.685	-0.023	0.024
<i>Discount</i>	0.131	0.009	0.083	0.862	-0.008
<i>Price</i>	-0.061	-0.007	-0.006	0.845	0.197
<i>Taste</i>	-0.071	0.146	0.027	0.196	0.808
<i>Quality</i>	-0.087	0.482	0.080	0.021	0.636

Source: SPSS, own processing.

mindless, haphazard, and convenient purchasing without a settled view of the preferences of any of the factors. It also contains the greatest number of factors. Factors such as emotional buying, promotions such as discounts, and big packaging where the result is an unconsidered purchase are related to the form of buying. After the purchase, there is a large amount of prepared food that is not consumed, improper storage conditions, and food spoilage. The determinant of *Sustainability* is made up of factors related to environmental protection, sustainable production, sustainable consumption, healthy lifestyles, healthy diets, or organic crop or livestock farming. The determinant of *Food usability* is determined by the condition of the food, and its edibility after purchase. The determinant of *Pricing* is determined by factors relating to price, discount, and financial advantage and are decisive for the customer. For the determinant *Quality* the taste and quality of the product is decisive, and the price is suppressed. From the factor loadings achieved, it can be deduced that groups of consumers focused on quality and taste, consumers focused on price, consumers aware of their responsibility for the environment and for sustainability, and then a large group of consumers buying food impulsively, without any opinion, have been created. This large group of shoppers represents the potential for behavioral change.

It was also the authors' intention to try to find out how resourceful households are and what measures they take in relation to waste and how they behave toward sustainable consumption and environmental protection. 14 content questions developed on this topic with the respondents' opinions were evaluated using the factor analysis method. The assumptions of using factor analysis are met (KMO 0.759, Bartlett's Chi-square test 1706.17; $p < 0.001$), with only a cumulative expression of explained variability of 45% (Table 5). Table 5 shows that the factors are newly explained by the three newly created components ("*Sustainable behavior*," "*Thoughtful purchase*," "*Zero waste*"), which contain a cumulative percentage of variability of 45.74%. These components are constructed based on Eigenvalue >1 and are in bold.

These 14 factors (a list of which is included in Table 6) created 3 hypothetical variables, namely "*Sustainable behavior*," "*Thoughtful purchase*," "*Zero waste*." Factors that significantly contribute to the formation of the component are marked in bold (factor loadings greater than 0.6). *Sustainable behavior* means a purchase that by its nature expresses a healthy lifestyle, and *Thoughtful purchase* expresses a relationship with environmental protection before purchase. *Zero waste* means that the household makes an effort to reuse food. Thus, it seeks a use for the food it cannot consume at a given time and creates a supply for other consumers.

TABLE 5 Components of factors of measure to reduce waste.

Component	Initial eigenvalues			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Sustainable behavior = 1	3.087	22.051	22.051	2.300	16.428	16.428
Thoughtful purchase = 2	2.048	14.628	36.679	2.118	15.131	31.559
Zero waste = 3	1.269	9.062	45.741	1.985	14.182	45.741
4	0.962	6.874	52.615			
5	0.939	6.710	59.325			
6	0.834	5.957	65.282			
7	0.761	5.437	70.719			
8	0.727	5.195	75.914			
9	0.719	5.133	81.048			
10	0.622	4.446	85.494			
11	0.581	4.149	89.642			
12	0.553	3.953	93.595			
13	0.505	3.609	97.204			
14	0.392	2.796	100.000			

Total Variance Explained. Extraction Method: PCA. Source: SPSS.

TABLE 6 Rotated component matrix (Extraction method: PCA; Rotation method: Varimax with Kaiser normalization; Rotation converged in 6 iterations).

	Hypothetical variables (determinants)		
	1 Sustainable behavior	2 Thoughtful purchase	3 Zero waste
<i>Buying seasonal products</i>	0.785	0.058	0.031
<i>Buying local products</i>	0.774	0.033	0.079
<i>Limiting meat consumption</i>	0.610	-0.123	0.101
<i>Restriction of IPF consumption</i>	0.576	0.278	-0.017
<i>I make a list before shopping</i>	0.046	0.641	0.196
<i>I check the expiry date and choose the longest ones</i>	-0.070	0.602	0.082
<i>I use the products to prepare other meals</i>	0.076	0.575	0.320
<i>Packaging waste sorting</i>	0.387	0.532	-0.195
<i>Reducing food waste</i>	0.428	0.523	-0.133
<i>I freeze the food and eat later</i>	-0.051	0.500	0.413
<i>I prepare preserves (pasteurization)</i>	-0.053	0.047	0.741
<i>I feed the animals</i>	-0.011	-0.046	0.691
<i>I share the excess food with others</i>	0.112	0.193	0.600
<i>I try to buy less</i>	0.130	0.264	0.455

IPF, industrially processed food.

Discussion

In order to achieve the objective of the paper, i.e., to identify the factors that influence consumers when buying food, a large-scale representative survey of 732 respondents was conducted. Respondents commented on a range of factors related to sustainable consumption, food purchasing patterns, food waste, and behavior in the context of environmental sustainability. As the survey showed, most respondents

have narrowed down the issue of environmental sustainability to food waste and waste segregation. Similarly to Purvis et al. (2019), we verified that respondents' behavior in relation to environmental sustainability is also linked to economic and social sustainability, and subconsciously this may influence opinion.

The influence of external factors acting on consumers, which include demographic characteristics (Hawkins et al., 2003), was investigated by asking how these characteristics influence the

frequency of food waste. A significant influence was verified for two sociodemographic characteristics, namely between generations and also the number of children in the household. The generalization of these results suggests that younger generations have a positive attitude toward environmental sustainability issues, which is in line with Orea-Giner and Fusté-Forné (2023) and Liu et al. (2021). According to Damico et al. (2023), Generation Z shows a high level of interest in the sustainability of the planet and is most aware of the benefits that sustainability brings. A study by Shen et al. (2022) showed that psychosocial variables (such as attitudes, beliefs, and subjective norms) have more influence on consumers' food purchase intention than demographic data. Therefore, it would be appropriate to focus on this Generation Z and examine psychosocial factors more closely rather than sociodemographic factors. The results also showed that neither education nor the size of the place of residence has an impact on the frequency of wastage. The results also showed that neither education nor degree of urbanization has an effect on the frequency of wastage. This is in contrast to the finding of Kubíčková et al. (2021), where higher wastage was found to occur in urban developments.

Another highly conclusive externality is the influence of shopping mode (small purchases frequently to large purchases occasionally). The influence of shopping mode on the frequency of consumer wastage speaks to the possibility of educating for sustainability – just through changing shopping behavior. Here there is room for tailoring promotional activities, the form and content of communication to consumers according to the different ways of shopping (Su et al., 2019). Alternatively, there is scope for further research in the field of marketing communication.

The survey shows that the most wasted foods are bakery products, followed by fruit and vegetables. This is in line with research (Pires et al., 2021; Morávková et al., 2022). Greater wastage with ready meals is then in line with Kubíčková et al. (2021). Almost 50% of respondents (households) make larger food purchases with occasional emergency replenishment. This trend became apparent with the onset of the COVID-19 pandemic when households just started to focus on larger purchases (Morávková et al., 2022). The cause of wastage is then just food spoilage caused by buying large quantities of food (Pires et al., 2021; Morávková et al., 2022). According to Parfitt et al. (2010), the structure of waste is related to household consumption habits, and therefore marketing communication should also aim at changing habits.

Above all, manufacturers and retailers expect to identify the factors that influence consumer behavior and be able to anticipate changes in consumer behavior in advance. They can use factor analysis to identify the factors influencing wastage in developing their production or business strategies based on the findings on the importance of each factor and reduce them to 5 determinants influencing the magnitude of wastage, which are: “Sustainability” and targeted education with appropriate tools, “Food usability” which is a recommendation to producers by the quality of food, offering new types of food with longer shelf life, “Pricing,” because most customers, when choosing to satisfy their needs to eat, are consciously or unconsciously influenced by price and therefore the producer must take this fact into account. The exception is the group of consumers for whom the determinant “Quality” is, together with taste, the decisive factor. It remains to take into account the last determinant, which is the most important and most general in terms of its representation, called “Convenience.” It groups together factors which, in their content, concern both the way of buying and the way of behaving toward food, especially food waste.

By understanding this group of factors, their influence can be regulated in a controlled way, leading to less food wastage, food sufficiency in less developed countries, and, finally, the satisfaction of needs and a sustainable environment.

The results of the investigation suggest the importance of educating individuals to achieve less wasted food (Veselá et al., 2023). This is linked to the issue of global importance, which is food scarcity (The United Nations, 2017), and to the issue of a sustainable environment (Yue et al., 2020). However, the different ways of communicating and acting to reduce waste, as shown in the survey results, are not effective according to the respondents. In their opinion, the burden of education lies mainly on primary schools and parents. And here an opportunity opens up in the sense of the authors Hazuchová et al. (2020) and Morávková et al. (2022), according to which it is necessary to focus on the individual, his perception of the issue of waste and controlled action of appropriate tools to achieve a change in attitudes toward waste and subsequently achieve a reduced amount.

As the questionnaire survey always involved respondents' opinions, these may in some cases differ from reality, for example, about the frequency of wastage (van der Werf et al., 2020; Kubíčková et al., 2021). An example is the expression of the influence of price on wastage. 95% of respondents stated that food price does not influence wastage. When asked differently whether food price increases during inflation affect the frequency of wastage, the respondents' answers showed that food price had a highly conclusive effect on the frequency of wastage. This finding was verified by paired *t*-test, including the negative direction of influence. Thus, the study suggests that food price increases have an impact on wastage, just as the COVID-19 pandemic did (Pires et al., 2021; Morávková et al., 2022).

Conclusion

The paper deals with consumer behavior in the context of sustainable development of society. The results of the survey are a generalization of the opinions of respondents in the Czech Republic. A very important finding is the fact that society and the individuals who make it up have insufficient knowledge of sustainable development and narrow the whole issue down to the areas of food waste and waste sorting. Sustainable development, characterized by improving the quality of life, reducing the negative impact on the environment, increasing the use of renewable energy sources, minimizing waste and emissions, and generally promoting a sustainable lifestyle, implies a change in consumption behavior toward sustainability. This awareness needs to be achieved in the majority of society through appropriate consumer interventions. An appropriate intervention is education and upbringing (Veselá et al., 2023). The survey also made it clear that the focus of education lies primarily with primary schools and parents. Demographic characteristics have been shown to have a clear generational influence on behavior change, including food waste. Further research should look at how to educate consumers appropriately, both in schools and in households. Therefore, it is necessary to target communication with appropriate tools to the younger generation. Generation Z shows a high level of interest in the sustainability of the planet and is most aware of the benefits of sustainability (Damico et al., 2023). Therefore, it would

be useful to focus on this generation and examine more closely psychosocial characteristics such as attitudes, beliefs, and subjective norms rather than sociodemographic characteristics. The factor analysis used to understand the effect of 22 factors revealed that the most influential factors on consumers and to be targeted are “Quality” of food, and “Price,” therefore affordable. Other determinants are “Sustainability,” “Food usability,” and “Convenience.” Awareness of this finding provides scope for producers to gradually change the structure of food in favor of affordable and sustainably grown and processed food. The authors also sought to understand the measures they take in relation to waste and their sustainable consumption and environmental protection. They created 14 content questions on this topic and by using factor analysis, 3 hypothetical variables were created, namely “Sustainable behavior” which expresses a healthy lifestyle, “Thoughtful purchase” which expresses a relationship with environmental protection before purchasing and “Zero waste” which means that the household tries to make additional use of food.

The limitations of the survey and the results expressed include 90% representativeness of the sample in the selected characteristics. The individual variables being worked with are the respondents’ opinions and as such must be treated. Factor analysis to determine the determinants of the effect of the actions taken hypothetical variables leading to a reduction in wastage, only 45% of the explained variability was achieved.

From the results obtained from the factor analysis and in accordance with the authors cited, it is possible to recommend to producers and retailers, when developing strategies, to focus on (1) food quality and its sustainability, changing the structure of food due to the interest in healthy food and to follow a healthy lifestyle, while maintaining affordability; (2) respecting the size of households and thus the size of food packaging; (3) innovating ways and techniques of packaging products (avoiding large amounts of packaging waste, inappropriate materials, etc.); (4) avoiding the use of packaging materials, etc. (4) recommend to public administration and local authorities to communicate with the population about the need to change consumption behavior as a prerequisite for achieving sustainable living.

The authors see the need (as revealed by the results of the investigation so far) to continue research to contribute to the knowledge of how to change consumption behavior toward sustainable consumption. In particular, the identification of psychosocial variables (attitudes, beliefs, subjective norms) is crucial for changing consumption behavior (Shen et al., 2022). These psychosocial variables are based on the Theory of Planned Behavior (TPB) and which can be investigated through questionnaire surveys (Ajzen, 2006). To these psychosocial variables, other variables can be added depending on the specific consumption behavior problem under investigation. Furthermore, it is necessary to focus on the effectiveness of selected

communication tools leading to sustainable consumption (education in schools, leisure activities, local governments, etc.). The effectiveness of selected communication channels could be investigated on Generation Z. This generation will soon start to start families and the real behavioral patterns they will start to pass on to their offspring need to be in line with the sustainability of the planet.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

MP: Writing – original draft, Data curation, Formal analysis, Project administration, Funding acquisition. IB: Formal analysis, Methodology. JS: Writing – original draft, Supervision, Methodology, Conceptualization. AL: Writing – review & editing, Methodology.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire. 1–12. Available at: <https://www.researchgate.net/publication/235913732> (Accessed May 27, 2023).
- Aschemann-Witzel, J., Ares, G., Thøgersen, J., and Monteleone, E. (2019). A sense of sustainability? – how sensory consumer science can contribute to sustainable development of the food sector. *Trends Food Sci. Technol.* 90, 180–186. doi: 10.1016/j.tifs.2019.02.021
- Aungtichart, N., Fukushige, A., and Aryupong, M. (2020). Mediating role of consumer identity between factors influencing purchase intention and actual behavior in organic food consumption in Thailand. *Pakistan J. Commerce Soc. Sci.* 14, 424–449.
- Berčík, J., and Gálová, J. (2013). “Selected aspects of sustainable issues in food chain” in *Human capital and corporate responsibility*. WZ PCzest. (Czestochowa: Sekcja Wydaw), 7–26.

- Damico, A. B., Vecchio, Y., Masi, M., and Di Pasquale, J. (2023). Perceptions and attitudes of Argentine Zoomers towards sustainable food production. *Foods* 12:1019. doi: 10.3390/foods12051019
- Dorce, L. C., Da Silva, M. C., Mauad, J. R. C., De Faria Domingues, C. H., and Borges, J. A. R. (2021). Extending the theory of planned behavior to understand consumer purchase behavior for organic vegetables in Brazil: the role of perceived health benefits, perceived sustainability benefits and perceived price. *Food Qual. Prefer.* 91:104191. doi: 10.1016/j.foodqual.2021.104191
- Finch, W. H. (2019). *Exploratory factor analysis*. Thousand Oaks: SAGE Publications: 144
- First Insight and The Baker Retailing Center. (2021). The State of Consumer Spending: Gen Z Influencing All Generations to Make Sustainability-First Purchase Decisions. Available at: <https://www.firstinsight.com/press-releases/the-state-of-consumer-spending-gen-z-influencing-all-generations-to-make-sustainability-first-purchase-decisions> (Accessed July 15, 2023).
- Flanagan, A., and Priyadarshini, A. (2021). A study of consumer behaviour towards food-waste in Ireland: attitudes, quantities and global warming potentials. *J. Environ. Manag.* 284:112046. doi: 10.1016/j.jenvman.2021.112046
- Francis, A., and Sarangi, G. K. (2022). Sustainable consumer behaviour of Indian millennials: some evidence. *Curr. Res. Environ. Sustain.* 4:100109. doi: 10.1016/j.crsust.2021.100109
- Hague, P. N., and Harrison, M. (2022). *Market research in practice: An introduction to gaining greater market insight. 4th Edn*. London: KoganPage.
- Hawkins, D. J., Best, R. J., and Coney, K. A. (2003). *Consumer behavior: Building marketing strategy*. Beijing: Machine Industry Press.
- Hazuchová, N., Antoňová, I., and Stávková, J. (2020). Food wastage as a display of consumer behaviour. *J. Competit.* 12, 51–66. doi: 10.7441/joc.2020.02.04
- Hazuchová, N., Stávková, J., Siedlecka, A., and Nagyová, L. (2022). Consumers' stance on food waste in the Czech Republic, Poland, and Slovakia. *AIMS Agric. Food* 7, 637–658. doi: 10.3934/agrfood.2022040
- Holotová, M., Horská, E., and Nagyová, L. (2021). Changing patterns of sustainable food consumption regarding environmental and social impact-insights from Slovakia. *Front. Sustain. Food Syst.* 5. doi: 10.3389/fsufs.2021.703827
- Hoogland, C. T., Joop De Boer, J., and Boerema, J. J. (2005). Transparency of the meat chain in the light of food culture and history. *Appetite* 45, 15–23. doi: 10.1016/j.appet.2005.01.010
- Jungowska, J., Kulczyński, B., Andrzej Sidor, A., and Gramza-Michałowska, A. (2021). Assessment of factors affecting the amount of food waste in households run by polish women aware of well-being. *Sustainability* 13:976. doi: 10.3390/su13020976
- Kiliç, B., Bekar, A., and Yozukmaz, N. (2021). “The new foodie generation: gen Z” in *Stylos, generation Z marketing and management in tourism and hospitality* (Cham: Springer International Publishing), 223–247.
- Kubičková, L., Veselá, L., and Kormaňáková, M. (2021). Food waste behaviour at the consumer level: pilot study on Czech private households. *Sustainability* 13:1311. doi: 10.3390/su132011311
- Liu, H., Meng-Lewis, Y., Ibrahim, F., and Zhu, X. (2021). Superfoods, super healthy: myth or reality? Examining consumers' repurchase and WOM intention regarding superfoods. *J. Bus. Res.* 137, 69–88. doi: 10.1016/j.jbusres.2021.08.018
- Lubowiecki-Vikuk, A., Dąbrowska, A., and Machnik, A. (2021). Responsible consumer and lifestyle: sustainability insights. *Sustain. Product. Consumpt.* 25, 91–101. doi: 10.1016/j.spc.2020.08.007
- Macková, M., Hazuchová, N., and Stávková, J. (2019). Czech consumers' attitudes to food waste. *Agric. Econ.* 65, 314–321. doi: 10.17221/364/2018-AGRICECON
- Marrakech Process Secretariat: UNDESA and UNEP. (2010). Paving the way to sustainable consumption and production. 10YFP ON SCP. Available at: http://www.un.org/esa/dsd/resources/res_pdfs/csd-18/csd18_2010_bp4.pdf (Accessed June 20, 2023).
- Moras, T. G., Teixeira, R. F. M., Lauk, C., Theurl, M. C., Winiwarter, W., Mayer, A., et al. (2021). Agroecological measures and circular economy strategies to ensure sufficient nitrogen for sustainable farming. *Glob. Environ. Chang.* 69:102313. doi: 10.1016/j.gloenvcha.2021.102313
- Morávková, M., Veselá, L., and Kubičková, L. (2022). Changes in households' stances on wasting food during the COVID-19 pandemic. *Waste Forum* 3, 161–178.
- Moschis, G. P., Mathur, A., and Shannon, R. (2020). Toward achieving sustainable food consumption: insights from the life course paradigm. *Sustainability* 12:5359. doi: 10.3390/su12135359
- Orea-Giner, A., and Fusté-Forné, F. (2023). The way we live, the way we travel: generation Z and sustainable consumption in food tourism experiences. *Br. Food J.* 125, 330–351. doi: 10.1108/BFJ-11-2022-0962
- Parfitt, J., Barthel, M., and Macnaughton, S. (2010). Food waste within food supply chains: quantification and potential for change to 2050. *Philos. Trans. Royal Soc. B* 365, 3065–3081. doi: 10.1098/rstb.2010.0126
- Pew Research Center. (2019). Defining Generations: Where Millennials End and Generation Z Begins. Available at: <https://www.pewresearch.org/fact-tank/2019/01/17/where-millennials-end-and-generation-z-begins/>
- Pires, I. M., Fernández-Zamudio, M. A., Vidal-Mones, B., and Beltrão Martins, R. (2021). The impact of COVID-19 lockdown on Portuguese households' food waste behaviors. *Hum. Ecol. Rev.* 26, 59–69. doi: 10.22459/HER.26.01.2020.06
- Puntiroli, M., Moussaoui, L. S., and Bezençon, V. (2022). Are consumers consistent in their sustainable behaviours? A longitudinal study on consistency and spillover. *J. Bus. Res.* 144, 322–335. doi: 10.1016/j.jbusres.2022.01.075
- Purvis, B., Mao, Y., and Robinson, D. (2019). Three pillars of sustainability: in search of conceptual origins. *Sustain. Sci.* 14, 681–695. doi: 10.1007/s11625-018-0627-5
- Qi, X., and Ploeger, A. (2019). Explaining consumers' intentions towards purchasing green food in Qingdao, China: the amendment and extension of the theory of planned behavior. *Appetite* 133, 414–422. doi: 10.1016/j.appet.2018.12.004
- Reisch, L. A., and Thøgersen, J. (2015). *Handbook of research on sustainable consumption*. Cheltenham, UK: Edward Elgar Publishing.
- Reynolds, C., Goucher, L., Quedsted, T., Bromley, S., Gillick, S., Wells, V. K., et al. (2019). Review: consumption-stage food waste reduction interventions – what works and how to design better interventions. *Food Policy* 83, 7–27. doi: 10.1016/j.foodpol.2019.01.009
- Rong-Da Liang, A. (2014). Enthusiastically consuming organic food. *Internet Res.* 24, 587–607. doi: 10.1108/IntR-03-2013-0050
- Šajn, N. (2020). Sustainable consumption: helping consumers make eco-friendly choices [online]. European Parliament. Available at: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659295/EPRS_BRI\(2020\)659295_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659295/EPRS_BRI(2020)659295_EN.pdf) (Accessed June 23, 2023).
- Shen, X., Xu, Q., LIU, Q., and Vasa, L. (2022). Predicting sustainable food consumption across borders based on the theory of planned behavior: a meta-analytic structural equation model. *PLoS One* 17, 17:5312. doi: 10.1371/journal.pone.0275312
- Southerton, D., Chappells, H., and Van Vliet, B. (2004). *Sustainable consumption: The implications of changing infrastructures of provision*. Cheltenham, UK: Edward Elgar Publishing.
- Su, C.-H. J., Tsai, C.-H. K., Chen, M.-H., and Lv, W. Q. (2019). U.S. sustainable food market generation Z consumer segments. *Sustainability* 11:3607. doi: 10.3390/su11133607
- The United Nations. (2017). *The future of food and agriculture: Trends and challenges; Food and Agriculture Organization of the United Nations*: Rome, Italy.
- Tobler, C., Visschers, V. H. M., and Siegrist, M. (2011). Eating green. Consumers' willingness to adopt ecological food consumption behaviors. *Appetite* 57, 674–682. doi: 10.1016/j.appet.2011.08.010
- Van Der Werf, P., Seabrook, J. A., and Gilliland, J. A. (2020). Food for thought: comparing self-reported versus curbside measurements of household food wasting behavior and the predictive capacity of behavioral determinants. *Waste Manag.* 101, 18–27. doi: 10.1016/j.wasman.2019.09.032
- Verain, M. C. D., Dagevos, H., and Antonides, G. (2015). Sustainable food consumption. Product choice or curtailment? *Appetite* 91, 375–384. doi: 10.1016/j.appet.2015.04.055
- Veselá, L., Králíková, A., and Kubičková, L. (2023). From the shopping basket to the landfill: drivers of consumer food waste behaviour. *Waste Manag.* 169, 157–166. doi: 10.1016/j.wasman.2023.07.002
- Watkins, M. W. (2021). *A step-by-step guide to exploratory factor analysis with SPSS*. New York, NY: Routledge Taylor & Francis Group.
- Yadav, R., and Pathak, G. S. (2016). Intention to purchase organic food among young consumers: evidences from a developing nation. *Appetite* 96, 122–128. doi: 10.1016/j.appet.2015.09.017
- Yue, S., Munir, I. U., Hyder, S., Nassani, A. A., Qazi Abro, M. M., and Zaman, K. (2020). Sustainable food production, forest biodiversity and mineral pricing: interconnected global issues. *Res. Policy* 2020, 65:101583. doi: 10.1016/j.resourpol.2020.101583