

Milena ZIĘBA

Adam Mickiewicz University, Poland
Faculty of Geographical and Geological Sciences
e-mail: milzie@st.amu.edu.pl
ORCID: 0000-0002-8853-7747

PROBLEM OF FOOD WASTE BASED ON A SURVEY AMONG YOUNG CITIZENS IN POZNAŃ AT HOUSEHOLD LEVEL

Abstract: Food waste has a negative impact on people around the world, affecting the economy, environment, and society. Recognized as an international problem, much effort has been taken to identify goals and potential measures to reduce waste at every stage of the supply chain, both domestically and globally. This paper presents the results of a survey conducted among young adult residents (aged 18–25) of Poznań, a city with a population of over 500,000, with the aim of identifying the reasons for food waste by consumers, exploring methods to reduce it, and determining the level of public awareness of the issue and its consequences at household-level. The study found that consumers have difficulty purchasing adequate amounts of food and tend to prepare excessively large portions. The results provide valuable information for local governments, municipal authorities, companies, shops, schools, and other institutions that can use it to organize educational and informational campaigns targeted at consumers.

Key words: food waste, social awareness, consumer, best before date

Acknowledgements

The study has been financially supported by the 4th edition of the Study@research competition organized within the Program “Inicjatywa Doskonałości – Uczelnia Badawcza” (ID-UB), application no. 034/34/UAM/0020. Particular thanks are due to Sylwia Bródka, Robert Kudłak and Bartosz Stępiński for their kind assistance.

INTRODUCTION

The global annual food waste in the entire chain of supply, according to FAO, reaches around 1.3 billion tonnes (FAO 2011). According to the estimates of FUSIONS (Food Use for Social Inno-

Wpłynęło: 15.01.2023

Zaakceptowano: 20.03.2023

Zalecany sposób cytowania / Cite as: Zięba M., 2022, Problem of food waste based on a survey among young citizens in Poznań at household level, *Prace i Studia Geograficzne*, 67.4, Wydział Geografii i Studiów Regionalnych Uniwersytetu Warszawskiego, Warszawa, 89–106, DOI: 10.48128/pisg/2022-67.4-05.

vation by Optimizing Waste Prevention Strategies) in the EU countries, the amount of wasted food is 88 million tonnes annually, which per one EU citizen reaches 173 kg annually (Caldeira *et al.* 2019). The greatest contributors to this result are consumers (Principato *et al.* 2018; Qusted and Johnson 2009; Beretta *et al.* 2013; Silvennoinen *et al.* 2014). In Poland, the annual amount of wasted food in the entire chain of supply is 4.8 million tons, of which 60% is wasted by consumers (Fig. 1), (Łaba *et al.* 2020a).

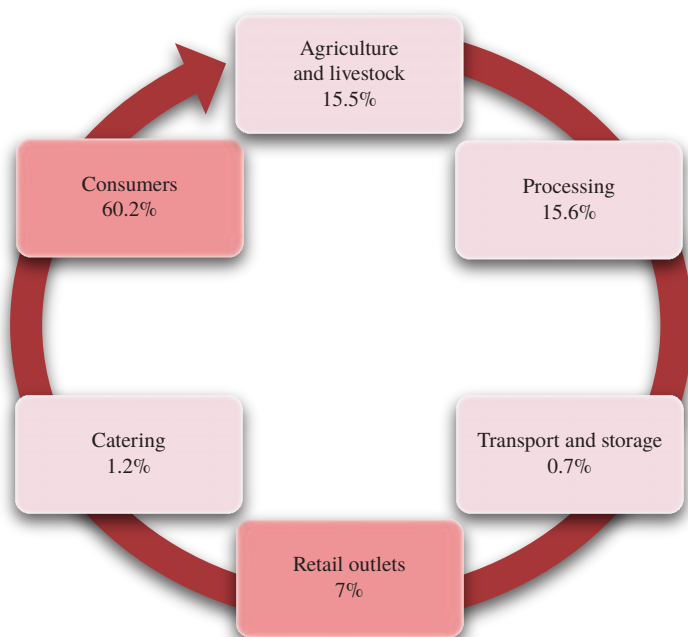


Fig. 1. Contributions of particular links in the chain of supply in the waste of food in Poland (catering includes the amount of wasted food in foodservice kitchens)

Source: Own study based on the data from Łaba *et al.* (2020).

Food waste has different definitions in scientific and legal literature. In Poland, in the Act of 19 July 2019 on combating food waste (Journal of Law 2019, item 1680), food waste is defined as the withdrawal from distribution of food products that still satisfy the requirements of the law of food products, in particular because of nearing “use by” date or date of minimum durability, and utilization of such food as waste. However, this Law refers to retail outlets and not to the entire chain of supply. According to the Polish Association of Food Technologists, food waste refers to all resources and food products dedicated to be eaten which have not been consumed, so have not been used according to specifications at all links of the chain of supply, from production, through processing and distribution to final household consumption (Łaba *et al.* 2020b). FAO (Food and Agriculture Organization of the United Nations) differentiates between food losses and waste and edible and inedible parts. Food waste is defined as all food products that have been wasted as a result of food losses and waste of food products (Bednarczuk, Śleszyński 2019). As follows from the above, there is no single and uniform definition of food waste, as each of the above given ones refers to a specific range or has a specific meaning. In consequence there is the problem with making reliable comparisons between different sets of data and literature (Borowski *et al.* 2016). Thus, any attempts to make predictions for the future are imprecise and need more research.

The aforementioned studies of food waste represent a diversity of conceptual approaches, as has been proved in the paper by Roodhuyzen *et al.* (2017), concerning the system of food waste made up

of interacting cause and effect elements. Some studies have been based on the analysis of individual links in the chain of supply and differentiate between food losses and food waste (HLPE 2014; Parfitt *et al.* 2010). Other authors follow different directions of study, concentrating on the amount or quality of the wasted food (Abdulla *et al.* 2013; Buzby, Hyman 2012). Some authors differentiate between the edible and inedible parts of the food waste (Nahman, De Lange 2013; Monier *et al.* 2011; HLPE 2014). Another area of discussion is the alternative use of food waste, such as the production of animal fodder and composting (Rutten 2013; Garrone *et al.* 2014), and the question of whether food waste also includes overeating by consumers (Gille 2012; Rutten 2013). Following the assumptions of the General Assembly of the United Nations, in realization of the aim 12.3, the level of global food losses and waste at the stage of consumption and retail trade should be reduced by half by 2030. It is most crucial as consumers produce most of the food waste. As mentioned above, food waste is related to significant economic, ecological, and social problems. Food waste is related to increased amount of general waste, intensification of agricultural production, animal husbandry, excessive use of water and consequently, significant emissions of pollutants and climate change (Scalvedi, Rossi, 2021). Limitation of the food waste situation among consumers has become one of the greatest challenges in developed countries because of their ever-increasing consumerism. Over many years of development, consumers have worked out certain types of behavior and attitudes towards food and eating (Bilska *et al.* 2019). Citizens of developing or low-income countries tend to waste food at the first stages of the chain of food supply, whereas those of the developed or high- or middle-income countries tend to waste food mainly at the stage of consumption (Roodhuyzen *et al.* 2017). In view of the above, it is important to identify the reasons for food waste by the consumers of countries at each stage of development and the implementation of measures that will promote the attitudes reducing the problem of food waste production. The dominant directions of investigation of consumer behavior in the context of food waste have been quantitative studies and analyses of the global effects of the food waste system (Russel *et al.* 2017). However, there is also a significant amount of qualitative research dedicated to analyzing the causes of food waste across the supply chain. For example, the research by Filimonau and Gherbin (2017), which focused on food waste management in the retail sector and the attitudes of managers to reduce food waste in supermarkets. In order to reduce food waste in retail outlets, methods of donating food are mainly used. However, due to low consumer awareness, limited control over suppliers, and corporate policies, reducing food waste by shop managers is difficult (Filimonau, Gherbin 2017). Furthermore, significant contributions to qualitative research are also provided by the research work of Filimonau *et al.* (2020), who analyzes the problems of food waste management in restaurants, including the role of consumers in generating food waste. The authors point out that the main reason for food waste in the catering sector is the high expectations of consumers regarding the catering offer and the desire of the catering sector to meet these demands, leading to overproduction of food. However, the catering sector is trying to combat this by, among other things, cooking meals for staff from unused food. Restaurant owners also receive support from the government to reduce the problem of food waste (Filimonau *et al.* 2020). Moreover, Quested *et al.* (2013) notes that the generation of food waste is the result of many repeated behaviors that increase the amount of food waste by consumers. They also indicate that the problem of food waste is less visible to the public, so the impact of social norms on consumer behavior is significantly reduced. However, financial issues (saving money), guilt, and the formation of appropriate consumer attitudes play an important role in reducing food waste. Furthermore, research shows that environmental issues and global food scarcity do not play an important role in reducing food waste among consumers (Quested *et al.* 2013).

In the literature review “The household wasteful behavior framework: A systematic review of consumer food waste”, a number of factors determining the food waste problem have been identified, including socio-economic and demographic ones. Among them are the eating habits of household members, the frequency of food products shopping, the purchase of products on sale and the size of households (Principato *et al.* 2021). Other important factors affecting food waste are everyday habits

of consumers, including planning of purchasing, food storage and use of leftovers (Stancu *et al.* 2016; Chandon, Wansink 2006). An important stage in the process of food waste is retail trade. Although the level of food waste in the shops is one of the lowest, the retail outlets have a significant indirect impact on the other links of the chain of food supply. Retail sellers influence the process of food production, and – more importantly – the behavior and choices of consumers. Moreover, in retail outlets a few links of the chain of food supply intertwine and interact (Cicatiello *et al.* 2017).

There is still an insufficient amount of actual research in current literature on the effective influence of consumer behavior in relation to food waste. Therefore, there is a need to conduct research on this topic and update the existing knowledge. The survey conducted provides an important source of data related to the problem of food waste by consumers and allows assessment of consumer awareness. The following article presents data obtained from a survey conducted over four months among the residents of the city of Poznań. The survey allowed us to obtain detailed qualitative data on the reasons why consumers waste food at home and while shopping, ways to reduce the amount of wasted food at home, and the state of public awareness in the context of food waste. According to the results, consumers have a problem with purchasing adequate amounts of food and tend to prepare too large portions of food. The result of the study provides valuable information for local governments, municipal authorities, companies, shops, schools or other institutions that may use it for organization of educational and informational campaigns addressed to consumers. Although the insights identified in the following study apply to the city of Poznań, much of it will be applicable to other cities with similar consumer consumption patterns.

On the basis of the current state of knowledge, presented in literature, a study was undertaken in order to achieve the following study aims: identification of the reasons for food waste by consumers, identification of the ways of dealing with the excess of food in households, assessment of the level of social awareness of food waste.

METHODOLOGY

Questionnaire study

A questionnaire has been prepared and made available through the website www.interankiety.pl. The link to the questionnaire has been distributed through social media platforms commonly used by Poznań residents. The questionnaire was available for four months, from February to May 2022.

The questionnaire contained 16 closed questions of either single-choice or multiple-choice answers. The first part included questions on the reasons for food waste in households and ways of dealing with excessive amounts of food, such as donating excessive food products to non-governmental organizations. The second part consisted of questions testing the social awareness of Poznań residents concerning food waste. The last part collected data characterizing the respondents, allowing the results to be analyzed according to sex, education, net monthly income, professional situation, and the number of children and adults in the household.

During the questionnaire design process, the following sources were used:

- Reports from the Federation of Polish Food Banks from the years 2017–2020
- Łaba S., Bilaska B., Tomaszewska M., Łaba R., Szczepański K., Tul-Kryszczuk A., Kosicka-Gębska M., Kołożyn-Krajewska D., 2020. Próba oszacowania strat i marnotrawstwa żywności w Polsce. *Przemysł spożywczy*, 1(11), pp. 11–20
- Tomaszewska M., Bilaska B., Kołożyn-Krajewska D., Piecek M., 2020. Analiza przyczyn marnotrawstwa żywności w polskich gospodarstwach domowych. In: *Straty i marnotrawstwo żywności w Polsce. Skala i przyczyny problemu*. Instytut Ochrony Środowiska, Państwowy Instytut Badawczy, pp. 107–127.

In addition, our own knowledge about the problem of food waste was obtained through conversations with consumers and individuals related to the food sector. In the case of questions developed independently, there is a possibility of looking at the problem of food waste from a different perspective than that used in the literature, but there is also a problem with comparing the data and relating the results obtained to previously conducted research.

Half of the responses provided by the respondents (mainly students) were selected for analysis, as the remaining part of the obtained responses was either not qualified for further analysis due to incorrect completion of the form or was designated for future analysis, as part of further research on the problem of food waste.

The questionnaire was completed by 1135 respondents, but the analysis was conducted on the responses of 665 respondents between the ages of 18 and 25. Over half of them have obtained an elementary or secondary school level of education and were working or studying, mainly in the service sector or in education, with a net monthly income lower than PLN 1500.

Detailed characterization of the respondents is given in Table 1.

RESULTS

Identified reasons for household food waste

The first part of the questionnaire aimed to find out the reasons for food waste by consumers at home, as shown in Fig. 2. The clear majority of respondents indicated problems with purchasing too many food products (46%) and preparing too large food portions (41%). Another important reason for food waste is spontaneous shopping without a previously list of needed products (36%), which leads to purchasing additional products on top of those needed for meal preparation. Consequently, some products are left unused and may deteriorate, or the time for safe consumption may have passed. Analysis of the data with respect to professional status revealed that students and employed individuals show a greater tendency to purchase excess amounts of food products than other groups. Those on disability or family pension tended to prepare too large meals, and the unemployed had problems with correct storage of food (69%), which can lead to food waste. Respondents were also asked to disclose their net monthly income; those with a net monthly income below PLN 3000 indicated purchasing too much food and preparing too large meals, while those in the range of PLN 3000–4000 tended to purchase food products in excessively large packages (41%). Respondents with a net monthly income in the range of PLN 4000–5000 admitted that one of the reasons for food waste in their households was purchasing too many products (64%) and frequently purchasing food products on discounts (50%), which led to buying excessive amounts of food. According to the questionnaire results, people living in households of two tend to purchase too many products (42%) and purchase products in excessively large packages (40%).

In response to the “other” entry, respondents indicated that food waste is often a consequence of organizing bigger meals parties at home, an irregular lifestyle, preparing new types of meals, trying new cuisines, problems with food products, or eating meals whenever was in a certain mood.

A common reason for purchasing excessive amounts of food is failing to plan meals ahead for a week or a month. Another reason is not shopping with a list and purchasing products that seem attractive at the moment. Therefore, one of the questions in the questionnaire referred to the habits of the respondents related to shopping. Over 50% of respondents declare that they sporadically buy more food products than originally planned, while 40% of respondents claim that they often happen to buy more spontaneously. Moreover, students and employed people were found to buy excess food more frequently than other respondent groups. The respondents of the net monthly income in the range PLN 4000–5000 show a greater tendency to more frequently buying of excessive amounts of food

Table 1. Characterization of respondents

Feature	Characteristics	Share [%]
1. Sex	Female	80.6
	Male	19.4
2. Education	Elementary or secondary	66.3
	High	33.7
3. Marital status	Single	94.0
	Married	2.4
	Divorced	0.3
	Do not want to disclose	3.3
4. Professional status	Secondary school student	2.1
	University-level student	94.7
	Employed	33.8
	Disability pension or survivor's pension	1.4
	Unemployed	2.0
5. Employment	Administration	2.1
	Health service	1.8
	Education	8.7
	Trade	7.5
	Gastronomy	7.7
	Other services	11.0
	Industry	1.5
	Transport	0.6
	Agriculture	0.8
	Unemployed	50.1
	Other	8.2
6. Net monthly income in PLN	Below 1,500	58.5
	1,500–3,000	28.4
	3,001–4,000	8.9
	4,001–5,000	2.1
	Above 5,000	2.1
7. District of Poznań you live in	Grunwald	15.0
	Jeżyce	19.2
	Nowe Miasto	22.1
	Stare Miasto	34.2
	Wilda	9.5
8. Number of adults in household	1	23.8
	2	34.7
	3	24.2
	4 and more	17.3
9. Number of children in household	0	86.5
	1	8.9
	2	2.6
	3 and more	2.0

Source: Own study, based on the questionnaire.

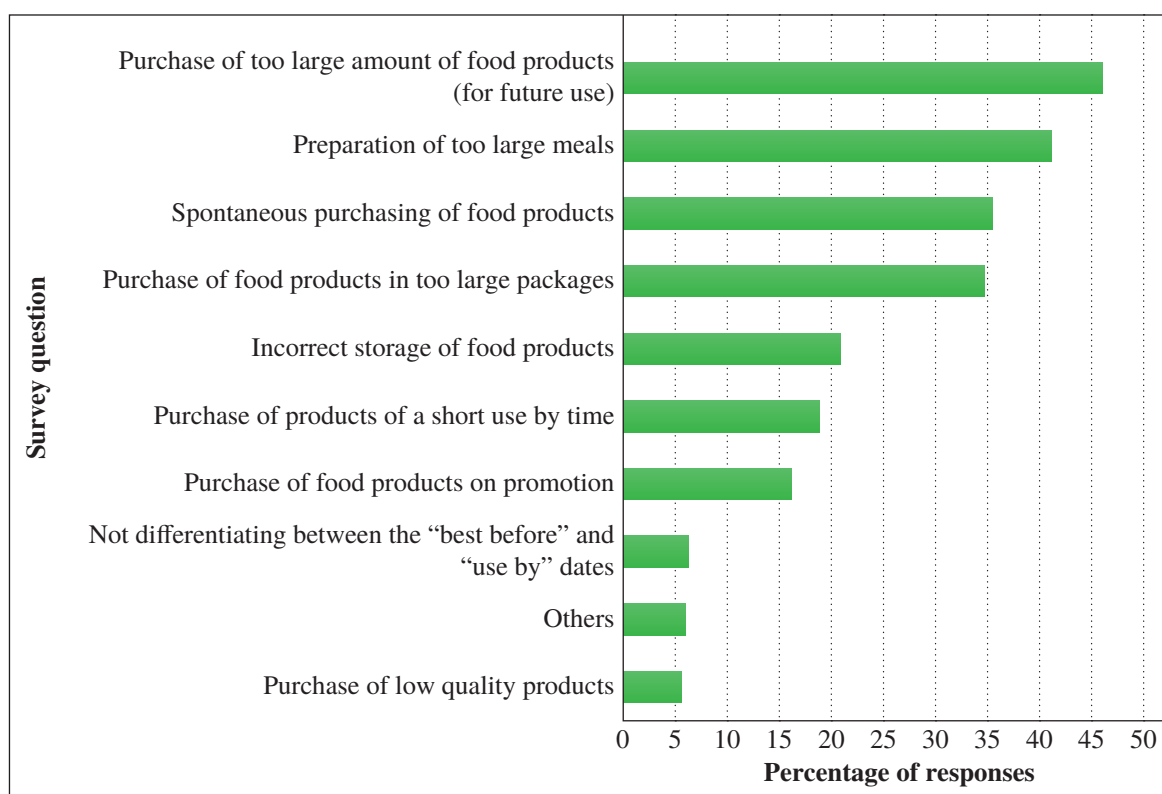


Fig. 2. The reasons for food waste by consumers at home
Source: Own study.

(64%) than the other income groups. The number of adults in a household has been found to have no impact on the purchase of greater amounts of food than planned, however, in the households with more than two children the purchase of excess food was more frequent than in those with one or two children.

It is known that everyday habits of consumers, the types of their activity during the day as well as the state of health may have impact on the eating choices. Many people choose to buy certain food products in consistence with particular types of behavior or circumstances, e.g. want to live a healthy lifestyle, apply a particular diet, have certain health problems or food allergies.

According to the respondents, the main factor influencing the choice of particular food products in a shop is the will to live a healthier lifestyle (42%) and application of a certain diet, e.g. vegetarian or vegan (34%). A significant proportion of respondents (25%) do not specify any factor that would influence the choice of food products, (Fig. 3). Women tend to choose particular products because of the choice a healthier lifestyle (44%) and because of following a specific diet (39%), while men indicate their need will to live a healthier lifestyle and physical activity as the main factors influencing their choices. The employed respondents also claim that the type of work they do may influence the choice of food products to be purchased (25%). Interestingly, the choices of the respondents whose net monthly income is greater than PLN 5000, are to the most strongly influenced on health problems (43%) and physical activity (43%).

Under the option "others" the respondents added that besides the above-mentioned factors their shopping preferences were also dependent on the nutrition value of products, will to protect the environment, pregnancy, children's taste preferences, economic situation of the family and the amount of time to be spent on shopping.

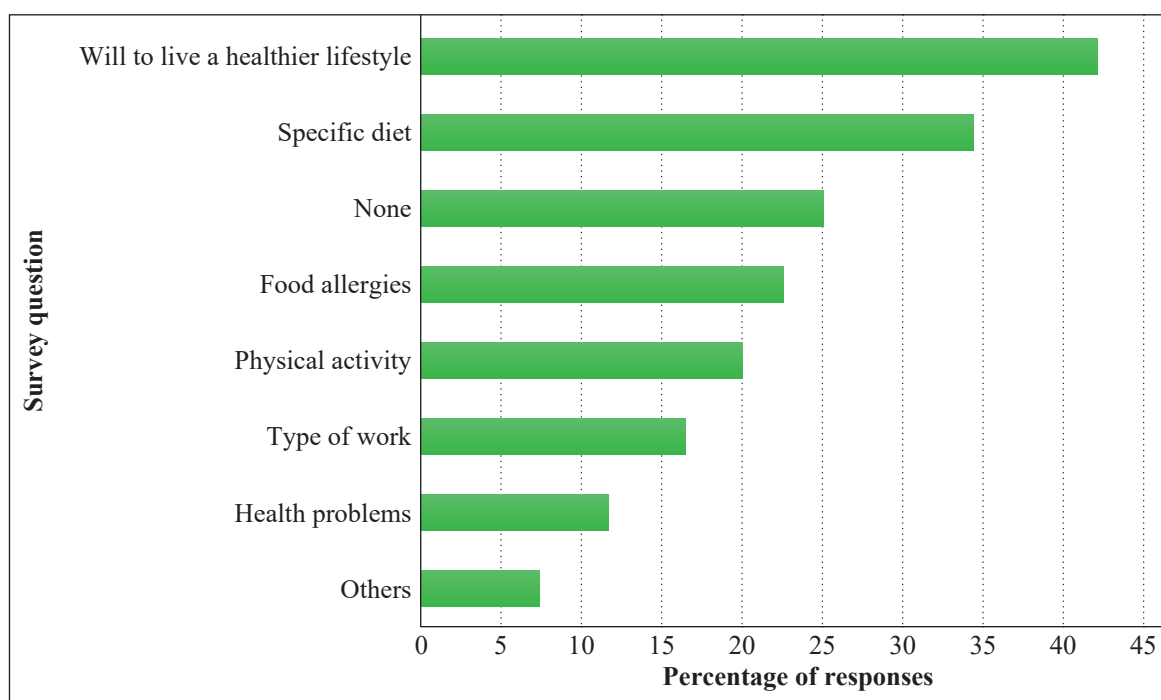


Fig. 3. The impact of lifestyle or health on the choice of food products purchased
Source: Own study.

The questionnaire also asked how often respondents throw away products past their “use by” date. The most common responses were “rarely” (56%) and “from time to time” (30%), with only 8% claiming to throw away food often.

The next question asked which products were most frequently thrown away. Vegetables and fruit were the most commonly disposed (54%), followed by dairy products (53%) and bread (47%). These products tend to deteriorate quickly and show signs of decomposition within a short period of time. Sweets (10%) and salty products (9%) were among the least frequently thrown away products, according to Figure 4. The results also showed that employed respondents most often threw away dairy products, while pensioners and those with 1–2 children most often threw away bread.

Under the “others” option, respondents mentioned that they most often throw away ready-made sauces, spreads (e.g., hummus), seasonings, dry products, and jams.

Measures and actions to prevent food waste problem

Control of the “use by” dates of food products is one of important measures to reduce food waste. Neglecting in this area leads to food deterioration and consequently to food losses. The respondents declared checking the “use by” dates a few times a week (36%) or once a week (36%). About 6% of the respondents declared checking these dates everyday (Fig. 5). People on pension and those with net monthly income in the range PLN 4000–5000 check these dates usually once a week.

Under the option “others” the respondents declared to check the “use by” dates prior to use of a given product, more or less often depending on the season, when a product is kept in the refrigerator for a long time and after the purchase of food products.

Checking the contents of refrigerators or pantry before shopping is also an important measure to reduce food waste. According to the questionnaire, 75% of respondents always check the content of

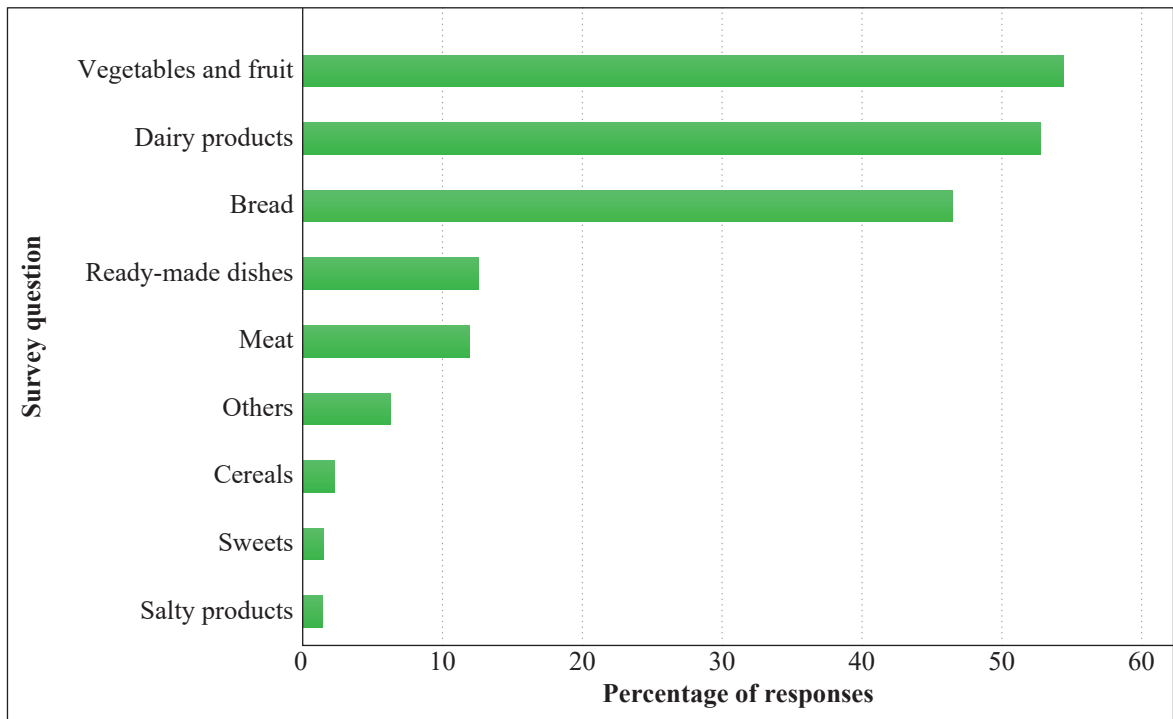


Fig. 4. Food products most often thrown away by consumers at home
Source: own study.

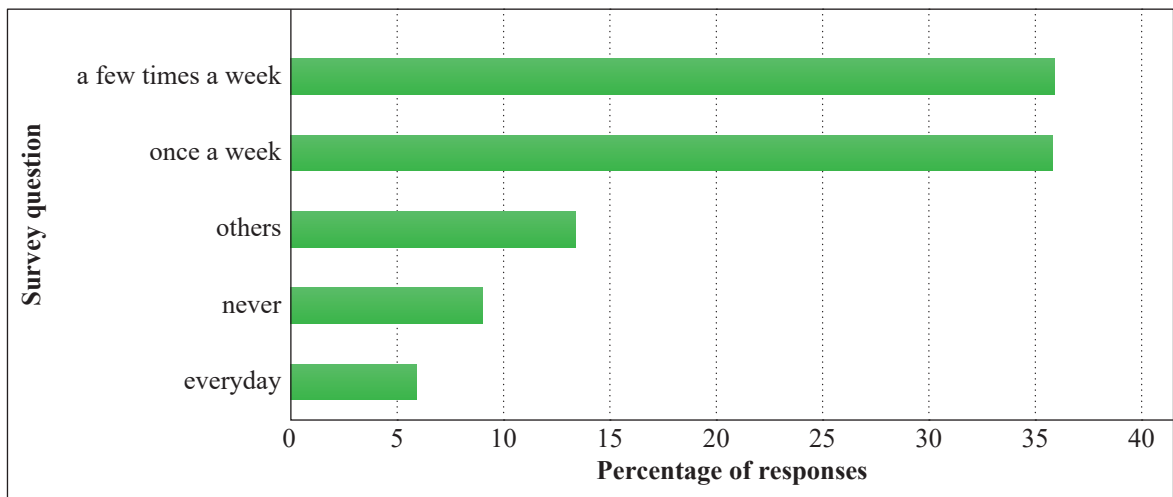


Fig. 5. Frequency of control of the best before and “use by” dates by consumers at home
Source: own study.

their refrigerators before going shopping, while 24% of respondents do it sporadically. Less than 1% of respondents declared not doing it at all.

Another measure that may significantly limit the food waste is making a shopping list and purchasing the products from the list. When shopping without the list people tend to make spontaneous choices of products according to what they think they might like and often buy products that they

already have at home. Analysis of the questionnaire responses have shown that 52% of respondents declared making shopping lists occasionally, while 45% of respondents always make a list. Only about 3% of respondents never make shopping lists, Fig. 6. According to the results, people with university level education show a greater tendency to make shopping lists always (51%) compared to a people with lower level of education (42%). Moreover, pensioners and the unemployed showed a greater tendency to making shopping lists than representatives of the other groups.

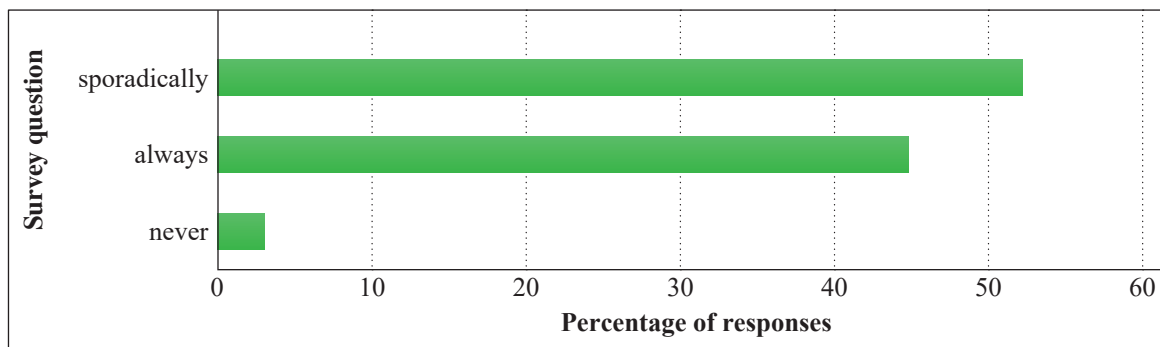


Fig. 6. Frequency of doing shopping according to a shopping list

Source: own study.

Retail sellers often offer discounts for on food products. It is the measure to reduce food waste applied by shops which attract buyers with lower prices of e.g. products with a nearing “use by” date. However, often such promotions lead to purchasing excess of food by consumers and contribute to food waste at the stage of consumers. The respondents were asked to declare if they buy food products with nearing “use by” date and if they use the 3 for the price of 2 deals. A large majority of respondents (59%) declared buying products with nearing ‘use by’ date and products on promotion (77%) only when a given product is needed.

The right way of food storage at home is an important measure contributing to limitation of food waste. Correct arrangement of particular groups of food products in a refrigerator or pantry may affect their “use by” date. Vast majority of respondents (93%) claim that they store food products in the correct way, while 5% of respondents do not pay any attention to the way of food storage.

Another question examined ways to deal with excess food left after meals. The majority of respondents claimed that leftovers were usually eaten later (89%). Some respondents also reported using leftovers for new meals (37%) or freezing them (34%). Donating to charities was the least common option (Fig. 7). This may be due to lack of knowledge of such charities among respondents. When asked if they knew of charities in the city of Poznań that accept donations of excess food, the majority of respondents answered that they did not know of any such organizations (81%). The respondents were also asked if they knew and used applications that help reduce food waste, such as ‘Too Good To Go’ or ‘Good Parcel.’ The majority of respondents answered that they did not use such applications (69%).

Social awareness on food waste

Food waste is closely related to consumers who are responsible for 60% of food waste in the entire chain of food supply in Poland (Łaba *et al.* 2020a). Thus, it is obvious that the consumer’s awareness of the problems of food waste and the level of their knowledge have impact on the amount of food waste and its utilization (processing). Consumers should be aware of the correct ways of food storage, what to check and prepare before going shopping and what are the consequences of food waste. The level of the respondents’ awareness of the above has been checked by asking them two questions. The

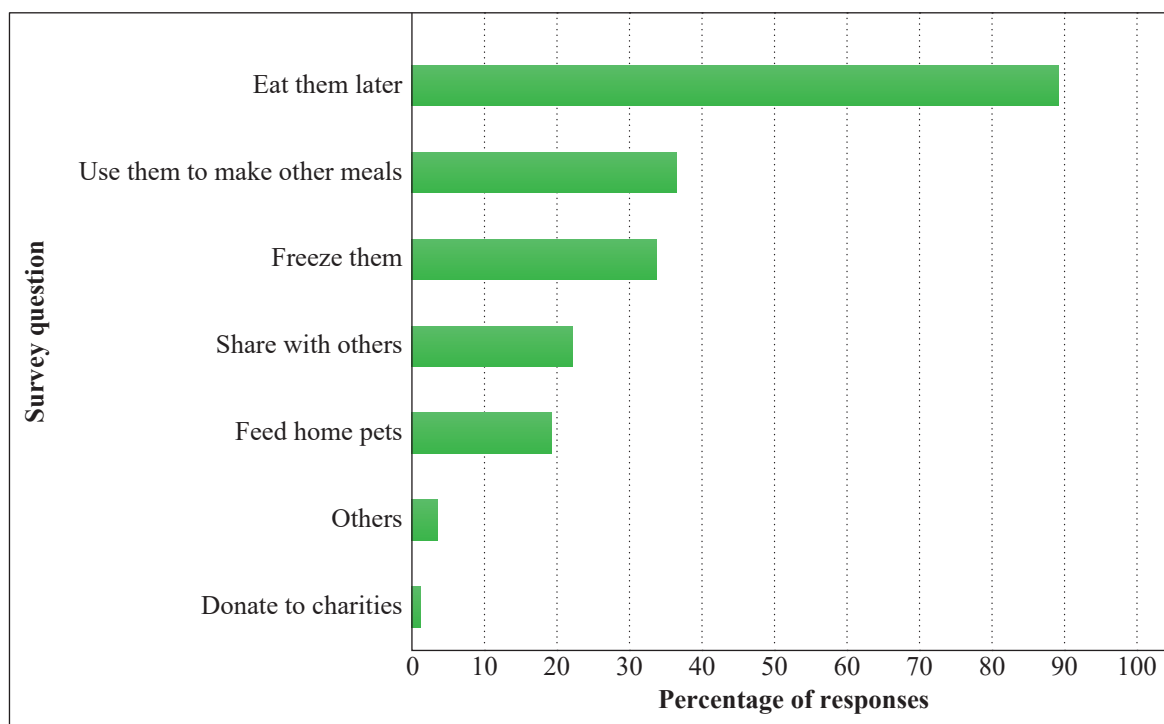


Fig. 7. The ways of using leftovers

Source: own study.

first one was which stage of the chain of food supply produces the most food waste. According to 32% of the respondents, the most food waste is produced by the retail outlets, 26% of the respondents answered that the most food waste is produced by gastronomy and consumers (Fig. 8). Women, people with elementary or secondary education and those with net monthly income below PLN 1500 claim that the most food waste is produced by retailer sellers followed by gastronomy and consumers. The respondents were also asked how much food goes is being wasted in Poland. According to “Program of rationalization of losses and limitation of food waste” (PROM), annually 4.8 million tons of food is wasted in Poland. The dominant answer of the respondents was “I do not know” (39%), while 32% of the respondents claim that it is 5–9 million tons, 16% indicated more than 9 million tons, only 12% of the respondents chose 3–5 million tons (Fig. 9).

DISCUSSION

The research allowed for an identification of the main factors influencing the amount of food waste produced by consumers aged 18–25, provided information on the main ways of reduce food waste by consumers and on the level of social awareness of the problem of food waste in Poland. All analyses were made on the basis of selected demographic features of residents of Poznań.

The main reasons for food waste production by consumers were found to include purchase of excess food and preparation of too large meals. It has been evidenced by many authors from all over the world that purchase of excessive amounts of food and food storage by consumers generates the most food waste (Evans 2011). The literature studies on the level of food waste versus the food management activities have revealed the complexity of factors that have impact on food waste. The tendency to

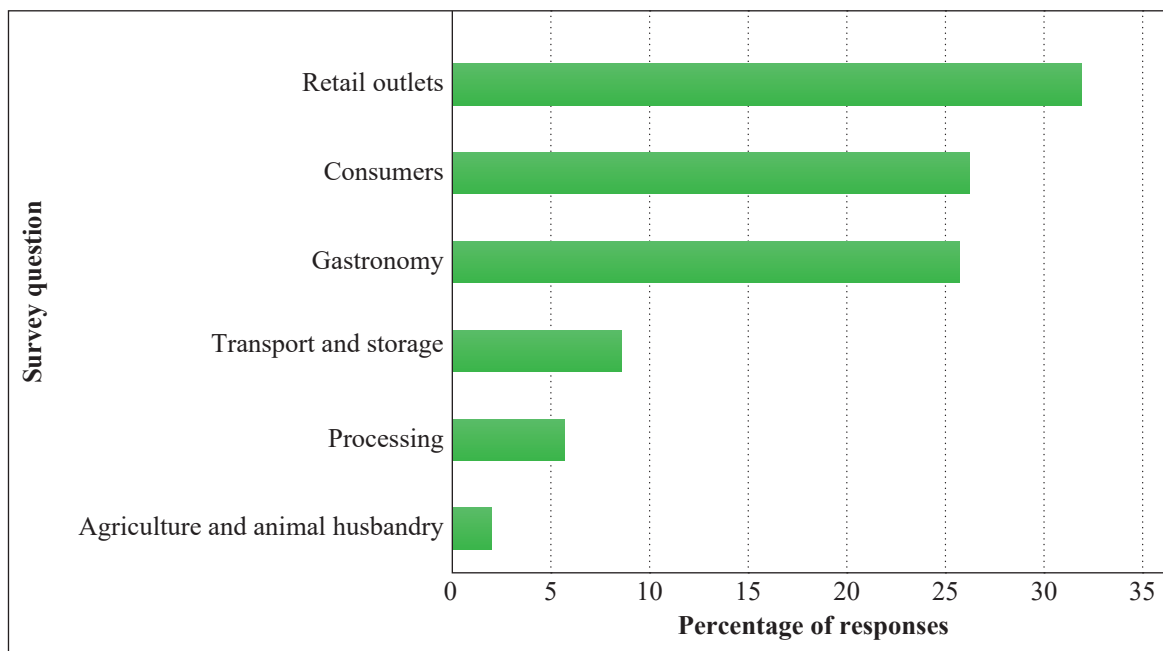


Fig. 8. Social awareness of the stages of the food supply chain producing the most food waste
Source: own study.

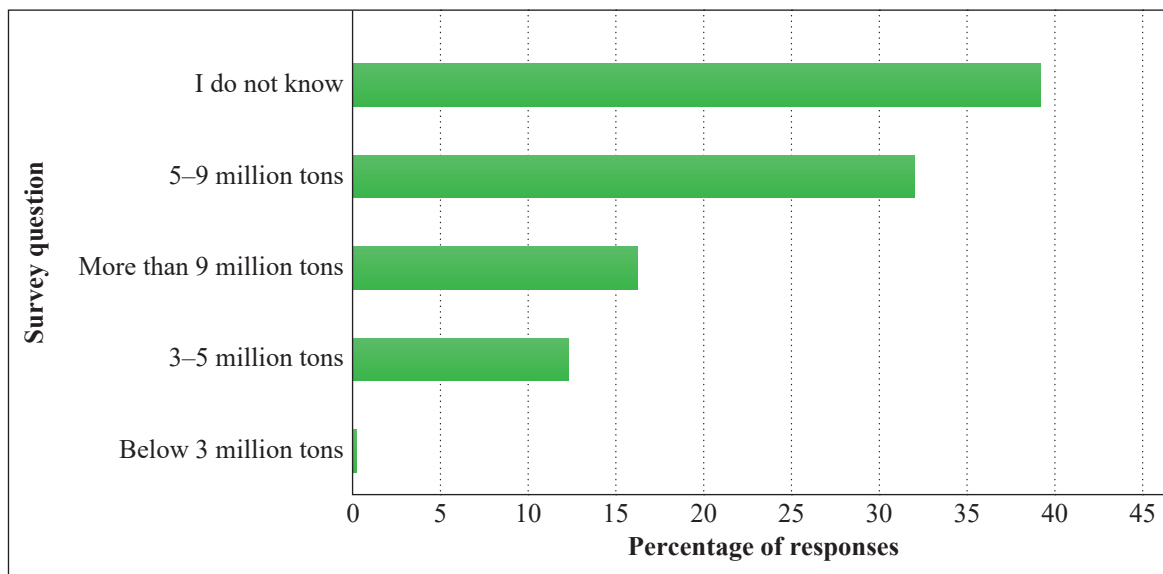


Fig. 9. Social awareness of the food wasted annually in Poland
Source: own study.

ensure appropriate amount of food at home, even despite financial losses it ensues, leads to purchasing of excess food and, consequently, generates food waste (Mallinson *et al.* 2016). Also preparation of too large meals contributes significantly generating more food waste. The leftovers are usually either subjected to further processing or treated as food waste (Katajajuuri *et al.* 2014). Another important factor conducive generating more food is the spontaneous way of doing shopping, with no earlier made

shopping list or no planned meals. In the paper entitled “Putting together the puzzle of consumer food waste: Towards an integral perspective”, the authors have shown that behavioral factors, that is the lack of planning and organization of food purchase may generate food waste (Roodhuyzen *et al.* 2017). Purchase of food products in too large packages also contributes to food waste generated. According to Williams *et al.* (2012), 20–25% of food waste is related to certain specific features of the packages, e.g. too large packages with too much food volume for a single person.

A considerable contribution to food waste comes from throwing away the products with the “best before” date mistaken for the “use by” date, although the product can still be safely eaten (Zielińska *et al.* 2020). As shown by Toma *et al.* (2020), the frequency of checking the “best before” or “use by” dates on the product label has a significant impact on consumers’ behavior. The person who regularly checks these dates more rarely eats products after these dates as they are not sure about the products’ quality. The majority of respondents declare checking the “use by” dates of food products a few times a week or once a week. It seems enough, although extra care must be taken to differentiate between the “best before” date and “use by” date, to avoid throwing away food that can still be eaten. Certain ways of behavior may also affect the amount of food waste. As follows from the questionnaire, half of the respondents claimed that they always check the contents of their refrigerators or pantries before shopping and make shopping lists, while nearly the same number of the respondents do it sporadically. According to the literature reports (Ananda *et al.* 2021; Roodhuyzen *et al.* 2017; Principato *et al.* 2021) planning shopping ahead is a very important factor leading to limitation of food waste. It may affect the food choice of consumers and minimize buying excessive amounts of food. As stated by the results of the questionnaire, the respondents generally make use of promotions offered by retail outlets (over 50%). The use of promotions offered by groceries has been frequently observed and reported in the previous research (Lyndhurst, WRAP 2010; Aschemann-Witzel *et al.* 2017). Unfortunately, as a result of these promotions, consumers are lured to buy more food products than they need, which consequently leads to increased food waste (Farr-Wharton *et al.* 2014; Le Borgne *et al.* 2018; Mondéjar-Jiménez *et al.* 2016).

At the stage of consumption, in household level, the factors significantly contributing to food waste are the lifestyle, amount of free time and state of health. In the study, the respondents have admitted that their food choices depend on the state of health and lifestyle. Most frequently they indicated that such a factor was a choice to have a healthier lifestyle. According to literature (Roodhuyzen *et al.* 2017), the person that wishes to live healthy lifestyle introduces more fresh vegetables, fruit and yogurts to their kitchens. However, these products deteriorate faster and consequently, those who have healthy diet generate more food waste, as proved also in (Giordano *et al.* 2019). Moreover, following a certain diet, e.g. vegan, may be related to an elevated level of food waste. Conrad *et al.* (2018) have proved that the people following high quality food diets generates more food waste, moreover, following such a diet often has a negative impact on the environment. The reason is that consumers when changing diet do not care about limiting food waste generation and its impact on the environment (Conrad *et al.* 2018). The questionnaire study was also aimed at eliciting the information on the kind of food products most often wasted by consumers. According to the respondents, the food products most frequently thrown away are vegetables, fruit and bread. Literature presents a diversity of opinions, however, the dominant opinion is that the products most heavily contributing to food waste generated at home are vegetables and fruit (Gaiani *et al.* 2018; Setti *et al.* 2016; Scalvedi, Rossi 2021). It may be related to the tendency of living healthier lifestyle or following the diet introducing healthy food, including more vegetables and fruit. Unfortunately, fruits and vegetables are the fastest to deteriorate so more likely to go to waste.

Studies performed in the area of fighting with food waste have also addressed the question of dealing with the excess of food by consumers. In the study reported here, where the respondents most often indicated eating the leftovers later or preparation of new meals but including the leftovers or freezing them. These solutions are relatively simple, but may considerably support the fight with

food waste. Similar ways of dealing with excess food have been indicated by Nikolaus *et al.* (2018), Muresan *et al.* (2022), Stancu *et al.* (2016).

The last part of the questionnaire study concerned evaluation of social awareness of the food waste problem in Poland. Unfortunately, over half of the respondents were not able to give a correct response to the question about the stage of food chain at which food waste is the greatest and about the amount of food products wasted annually in Poland. Most often the respondents indicated retail outlets as responsible to the highest degree for food waste, while the most common response to the question about the amount of food wasted in Poland was “I do not know”. As has been shown (Soma *et al.* 2020), the general level of social awareness of food waste problems is low. However, efforts have been taken to find means to elevate it. For instance, Soma *et al.* (2020) have shown that educational and informational campaigns may increase social awareness in this area and eventually lead to limitation of food waste at the stage of consumption. Furthermore, Yamakawa *et al.* (2017), based on two case studies, have demonstrated that local campaigns can reduce food waste among consumers by as much as 15%. According to Rasool *et al.* (2021), consumers are also influenced by advertisements and information communicated through social media. An example of such communication is the “Love Food, Hate Waste” campaign, in which issues and solutions related to food waste are conveyed through diverse media and direct activities, such as courses and workshops (Yamakawa *et al.* 2017; Buttlar *et al.* 2021). Educational and informational campaigns also draw attention to the problem of sub-optimal food, which is less frequently chosen by consumers during shopping (Hartmann *et al.* 2021). The conclusion was that food producers should direct their marketing strategies to include promotion of sustainable activities in the area concerning food and food products purchase (Rasool *et al.* 2021).

The above analyses suggest that the problem of food waste still plays an important role in our society. Therefore, it is important to seek solutions to the problem and conduct research that will likely identify strategies to reduce food waste among consumers. The conducted study enables the recognition of the causes of food waste that can be combated through the development of appropriate strategies by food-related businesses and city authorities, which can properly direct political strategies. In addition, educational institutions can include issues related to the problem of food waste in the curriculum and present the study results in schools. Moreover, the ways of reducing food waste indicated by the respondents enable consumers to apply them in practice, in everyday life. This will improve the quality of life of society in the future and change social attitudes towards sustainable development and better quality of the environment. The study can also change consumer habits during shopping, as there is a possibility that they will try to choose food products in such a way as to minimize food waste in households. Therefore, the profits of commercial establishments may significantly decrease in the future.

Soon, more research is planned to be conducted on food waste among consumers in the context of a closed-loop economy. The conducted study aimed to identify the general causes of food waste among young people, ways of dealing with the problem, and social awareness of food waste in an urban center. Based on this, the most priority aspects of food waste were selected for further, more detailed research.

LIMITATIONS

It is worth noting that by using an online method, the survey was able to reach a wider group of people, which on the one hand provided less control over the study group and non-probabilistic control during the study, but on the other hand allowed for opinions on food waste from people who wouldn't have been able to provide them through other forms of response collection. The survey was also conducted during the Covid-19 pandemic, and therefore efforts were made to ensure the

safety of the study participants and researchers, which was made possible by the online survey form, a method of collecting responses without the need for physical contact with the study participants. It was acknowledged that gender, age, and income inequalities may have influenced the survey results, so a group of young people who were most active during the survey was selected from the obtained responses. In addition, it was assumed that women are a group of people more involved in the problem of food waste (mainly responsible in Poland for shopping and meal preparation), so the possibility of obtaining a greater number of responses from women was also taken into account (e.g. Jungowska *et al.* 2021). In the context of income, given that most of the respondents were young people, the possibility of a majority of respondents with a low level of income was considered.

CONCLUSIONS

The questionnaire study was undertaken to identify the main reasons for food waste generation by consumers, the main ways of dealing with excessive amounts of food at home and to evaluate the level of social awareness in the area. As follows from the results, the main reasons for food waste indicated by the respondents was purchasing of excessive amount of food and preparation of too large meals at home. The ways to counteract food waste indicated by the respondents included eating the leftovers later, preparation of new meals with their use or freezing the leftovers to be eaten in future. The results of the questionnaire study also revealed the low level of social awareness of the food waste problem. The respondents were unable to correctly estimate the scale of the problem in Poland and were not aware that the greatest food waste is the responsibility of consumers. In general, the questionnaire has provided information on the problem of food waste at the stage of consumption that can be used by retail outlets, firms and education institutions in order to spread the information on food waste and methods to reduce the problem. The results may be a source of data for running informational and educational campaigns that are obligatory for retail outlets of area greater than 250 m².

Bibliography

- Abdulla M., Martin R., Gooch M., Jovel E., 2013, The Importance of Quantifying Food Waste in Canada, *Journal of Agriculture, Food Systems, and Community Development*, p. 137–151, DOI: 10.5304/jaf-scd.2013.032.018.
- Ananda J., Karunasena G.G., Mitsis A., Kansal M., Pearson D., 2021, Analysing behavioural and socio-demographic factors and practices influencing Australian household food waste, *Journal of Cleaner Production*, 306, DOI: 10.1016/j.jclepro.2021.127280.
- Aschemann-Witzel J., Jensen J.H., Jensen M.H., Kulikovskaja V., 2017, Consumer behaviour towards price-reduced suboptimal foods in the supermarket and the relation to food waste in households, *Appetite*, 116, p. 246–258, DOI: 10.1016/j.appet.2017.05.013.
- Bednarczuk A., Śleszyński J., 2019, Marnotrawstwo żywności – problem pomiaru i dostępności danych, *Optimum, Economic Studies*, 3, p. 19–32, DOI: 10.15290/oes.2019.03.97.02.
- Beretta C., Stoessel F., Baier U., Hellweg S., 2013, Quantifying food losses and the potential for reduction in Switzerland, *Waste Management*, 33(3), p. 764–773, DOI: 10.1016/j.wasman.2012.11.00.
- Bilska B., Tomaszewska M., Kołożyn-Krajewska D., 2019, Analysis of the Behaviors of Polish Consumers in Relation to Food Waste, *Sustainability*, 12(1), 304, DOI: 10.3390/su12010304.
- Borowski M., Kowalewska M., Kwasek M., Obiedzińska A., 2016, Z badań nad rolnictwem społecznie zrównoważonym [37], *Analiza strat i marnotrawstwa żywności na świecie i w Polsce* [in:] M. Kwasek (ed.), Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej – Państwowy Instytut Badawczy.

- Buttlar B., Löwenstein L., Geske M.-S., Ahlmer H., Walther E., 2021, Love Food, Hate Waste? Ambivalence towards Food Fosters People's Willingness to Waste Food, *Sustainability*, 13(7), 3971, DOI: 10.3390/su13073971.
- Buzby J.C., Hyman J., 2012, Total and per capita value of food loss in the United States, *Food Policy*, 37(5), p. 561–570, DOI: 10.1016/j.foodpol.2012.06.002.
- Caldeira C., De Laurentiis V., Corrado S., van Holsteijn F., Sala S., 2019, Quantification of food waste per product group along the food supply chain in the European Union: a mass flow analysis, *Resources, Conservation and Recycling*, 149, p. 479–488, DOI: 10.1016/j.resconrec.2019.06.011.
- Chandon P., Wansink B., 2006, How Biased Household Inventory Estimates Distort Shopping and Storage Decisions, *Journal of Marketing*, 70(4), p. 118–135, DOI: 10.1509/jmkg.70.4.118.
- Cicatiello C., Franco S., Pancino B., Blasi E., Falasconi L., 2017, The dark side of retail food waste: Evidences from in-store data, *Resources, Conservation and Recycling*, 125, p. 273–281, DOI: 10.1016/j.resconrec.2017.06.010.
- Conrad Z., Niles M.T., Neher D.A., Roy E.D., Tichenor N.E., Jahns L., 2018, Relationship between food waste, diet quality, and environmental sustainability, *PLOS ONE*, 13(4), DOI: 10.1371/journal.pone.0195405.
- Evans D., 2011, Blaming the consumer – once again: the social and material contexts of everyday food waste practices in some English households, *Critical Public Health*, 21(4), p. 429–440, DOI: 10.1080/09581596.2011.608797.
- FAO, 2011, *Global food losses and food waste: extent, causes and prevention*. Food and Agriculture Organization of the United Nations, Rome. Retrieved from <https://www.fao.org/3/i2697e/i2697e.pdf>
- Farr-Wharton G., Foth M., Choi J. H.-J., 2014, Identifying factors that promote consumer behaviours causing expired domestic food waste, *Journal of Consumer Behaviour*, 13(6), p. 393–402, DOI: 10.1002/cb.1488.
- Federacja Polskich Banków Żywności, *Nie marnuj jedzenia 2017–2020*.
- Filimonau V., Gherbin A., 2017, An exploratory study of food waste management practices in the UK grocery retail sector, *Journal of Cleaner Production*, 167, p. 1184–1194, DOI: 10.1016/j.jclepro.2017.07.229.
- Filimonau V., Zhang H., Wang L., 2020, Food waste management in Shanghai full-service restaurants: A senior managers' perspective, *Journal of Cleaner Production*, 120975, DOI: 10.1016/j.jclepro.2020.120975.
- Gaiani S., Caldeira S., Adorno V., Segrè A., Vittuari M., 2018, Food wasters: Profiling consumers' attitude to waste food in Italy, *Waste Management*, 72, p. 17–24, DOI: 10.1016/j.wasman.2017.11.012.
- Garrone P., Melacini M., Perego A., 2014, Opening the black box of food waste reduction, *Food Policy*, 46, p. 129–139, DOI: 10.1016/j.foodpol.2014.03.014.
- Gille Z., 2012, From Risk to Waste: Global Food Waste Regimes, *The Sociological Review*, 60, p. 27–46, DOI: 10.1111/1467-954X.12036.
- Giordano C., Alboni F., Falasconi L., 2019, Quantities, Determinants, and Awareness of Households' Food Waste in Italy: A Comparison between Diary and Questionnaires Quantities, *Sustainability*, 11(12), 3381, DOI: 10.3390/su11123381.
- Hartmann T., Jahnke B., Hamm U., 2021, Making ugly food beautiful: Consumer barriers to purchase and marketing options for Suboptimal Food at retail level – A systematic review, *Food Quality and Preference*, 90, 104179, DOI: 10.1016/j.foodqual.2021.104179.
- HLPE, 2014, *Food losses and waste in the context of sustainable food systems: A report by the High Level Panel of Experts on Food Security and Nutrition*, High Level Panel of Experts on Food Security and Nutrition (HLPE), Rome, Retrieved from <https://www.fao.org/3/i3901e/i3901e.pdf>
- Jungowska J., Kulczyński B., Sidor A., 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(2), 976, DOI: 10.3390/su13020976.
- Katajajuuri J.-M., Silvennoinen K., Hartikainen H., Heikkilä L., Reinikainen A., 2014, Food waste in the Finnish food chain, *Journal of Cleaner Production*, 73, p. 322–329, DOI: 10.1016/j.jclepro.2013.12.057.
- Le Borgne G., Sirieix L., Costa S., 2018, Perceived probability of food waste: Influence on consumer attitudes towards and choice of sales promotions, *Journal of Retailing and Consumer Services*, 42, p. 11–21, DOI: 10.1016/j.jretconser.2018.01.004.

- Lyndhurst B., WRAP (The Waste and Resources Action Programme), 2010, Helping consumers reduce food waste – A retail survey, WRAP, Banbury, Retrieved from <https://wrap.org.uk/sites/default/files/2020-12/Helping-consumers-reduce-food-waste-A-retail-survey-2009.pdf>
- Łaba S., Biliska B., Tomaszewska M., Łaba R., Szczepański K., Tul-Kryszczuk A., Kosicka-Gębska M., Kołoczyń-Krajewska D., 2020a, Próba oszacowania strat i marnotrawstwa żywności w Polsce, *Przemysł Spożywczy*, 1(11), p. 12–20, DOI: 10.15199/65.2020.11.2.
- Łaba S., Szczepański K., Łaba R., 2020b, Definicje i wytyczne w obszarze strat i marnowania żywności jako podstawa prowadzenia badań, w: *Straty i marnotrawstwo żywności w Polsce, Skala i przyczyny problemu*, Instytut Ochrony Środowiska, Państwowy Instytut Badawczy, p. 9–22.
- Mallinson L.J., Russell J.M., Barker M.E., 2016, Attitudes and behaviour towards convenience food and food waste in the United Kingdom, *Appetite*, 103, p. 17–28, DOI: 10.1016/j.appet.2016.03.017.
- Mondéjar-Jiménez J.A., Ferrari G., Secondi L., Principato L., 2016, From the table to waste: An exploratory study on behaviour towards food waste of Spanish and Italian youths, *Journal of Cleaner Production*, 138, p. 8–18, DOI: 10.1016/j.jclepro.2016.06.018.
- Monier V., Mudgal S., Escalon V., O'Connor C., Gibon T., Anderson G., Montoux H., 2011, Preparatory study on food waste across EU 27, European Commission.
- Muresan I.C., Harun R., Andreica I., Chiciudean G.O., Kovacs E., Oroian C.F., Brata A.M., Dumitras D.E., 2022, Household Attitudes and Behavior towards the Food Waste Generation before and during the COVID-19 Pandemic in Romania, *Agronomy*, 12(3), 746, DOI: 10.3390/agronomy12030746.
- Nahman A., de Lange W., 2013, Costs of food waste along the value chain: Evidence from South Africa, *Waste Management*, 33(11), p. 2493–2500, DOI: 10.1016/j.wasman.2013.07.012.
- Nikolaus C.J., Nickols-Richardson S.M., Ellison B., 2018, Wasted food: A qualitative study of U.S. young adults' perceptions, beliefs and behaviors, *Appetite*, 130, p. 70–78, DOI: 10.1016/j.appet.2018.07.026.
- Parfitt J., Barthel M., Macnaughton S., 2010, Food waste within food supply chains: quantification and potential for change to 2050, *Philosophical Transactions of the Royal Society B, Biological Sciences*, 365(1554), p. 3065–3081, DOI: 10.1098/rstb.2010.0126.
- Principato L., Mattia G., Di Leo A., Pratesi C.A., 2021, The household wasteful behaviour framework: A systematic review of consumer food waste, *Industrial Marketing Management*, 93, p. 641–649, DOI: 10.1016/j.indmarman.2020.07.010.
- Principato L., Pratesi C.A., Secondi L., 2018, Towards Zero Waste: an Exploratory Study on Restaurant managers, *International Journal of Hospitality Management*, 74, p. 130–137, DOI: 10.1016/j.ijhm.2018.02.022.
- Quested T., Johnson H., 2009, *Household Food and Drink Waste in the UK: A Report Containing Quantification of the Amount and types of Household Food and Drink Waste in the UK*, Report Prepared by WRAP (Waste and Resources Action Programme), Banbury, Retrieved from <https://wrap.org.uk/sites/default/files/2020-12/Household-Food-and-Drink-Waste-in-the-UK-2009.pdf>
- Quested T., Marsh E., Stunell D., Parry A.D., 2013, Spaghetti soup: The complex world of food waste behaviours, *Resources, Conservation and Recycling*, 79, p. 43–51, DOI: 10.1016/j.resconrec.2013.04.011.
- Rasool S., Cerchione R., Salo J., Ferraris A., Abbate S., 2021, Measurement of consumer awareness of food waste: construct development with a confirmatory factor analysis, *British Food Journal*, 123(13), p. 337–361, DOI: 10.1108/BFJ-02-2021-0160.
- Roodhuyzen D.M.A., Luning P.A., Fogliano V., Steenbekkers L.P.A., 2017, Putting together the puzzle of consumer food waste: Towards an integral perspective, *Trends in Food Science & Technology*, 68, p. 37–50, DOI: 10.1016/j.tifs.2017.07.009.
- Russell S.V., Young C.W., Unsworth K.L., Robinson C., 2017, Bringing habits and emotions into food waste behaviour, *Resources, Conservation and Recycling*, 125, p. 107–114, DOI: 10.1016/j.resconrec.2017.06.007.
- Rutten M.M., 2013, What economic theory tells us about the impacts of reducing food losses and/or waste: implications for research, policy and practice, *Agriculture & Food Security*, 2(1), DOI: 10.1186/2048-7010-2-13.
- Scalvedi M.L., Rossi L., 2021, Comprehensive Measurement of Italian Domestic Food Waste in a European Framework, *Sustainability*, 13(3), 1492, DOI: 10.3390/su13031492.

- Setti M., Falasconi L., Segrè A., Cusano I., Vittuari M., 2016, Italian consumers' income and food waste behavior, *British Food Journal*, 118(7), p. 1731–1746, DOI: 10.1108/BFJ-11-2015-0427.
- Silvennoinen K., Katajajuuri J.-M., Hartikainen H., Heikkilä L., Reinikainen A., 2014, Food waste volume and composition in Finnish households, *British Food Journal*, 116(6), p. 1058–1068, DOI: 10.1108/BFJ-12-2012-0311.
- Soma T., Li B., Maclaren V., 2020, Food Waste Reduction: A Test of Three Consumer Awareness Interventions, *Sustainability*, 12(3), 907, DOI: 10.3390/su12030907.
- Stancu V., Haugaard P., Lähteenmäki L., 2016, Determinants of consumer food waste behaviour: Two routes to food waste, *Appetite*, 96, p. 7–17, DOI: 10.1016/j.appet.2015.08.025.
- Toma L., Costa Font M., Thompson B., 2020, Impact of consumers' understanding of date labelling on food waste behaviour, *Operational Research*, 20, p. 543–560, DOI: 10.1007/s12351-017-0352-3.
- Tomaszewska M., Bilka B., Kołożyn-Krajewska D., Piecsek M., 2020. Analiza przyczyn marnotrawstwa żywności w polskich gospodarstwach domowych. w: *Straty i marnotrawstwo żywności w Polsce, Skala i przyczyny problemu*, Instytut Ochrony Środowiska, Państwowy Instytut Badawczy, p. 107–127.
- Williams H., Wikström F., Otterbring T., Löfgren M., Gustafsson A., 2012, Reasons for household food waste with special attention to packaging, *Journal of Cleaner Production*, 24, p. 141–148, DOI: 10.1016/j.jclepro.2011.11.044.
- Yamakawa H., Williams I., Shaw P., Watanabe K., 2017, *Food waste prevention: Lessons from the love food, hate waste campaign in the UK*, In Proceedings of the 16th International Waste Management and Landfill Symposium, Margherita di Pula, Sardinia, Italy, p. 2–6.
- Zielińska D., Bilka B., Marciniak-Lukasiak K., Lepecka A., Trzaskowska M., Neffe-Skocińska K., Tomaszewska M., Szydłowska A., Kołożyn-Krajewska D., 2020, Consumer Understanding of the Date of Minimum Durability of Food in Association with Quality Evaluation of Food Products After Expiration, *International Journal of Environmental Research and Public Health*, 17(5), 1632, DOI: 10.3390/ijerph17051632.