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Food Waste in Households in Poland—Attitudes of Young and Older Consumers towards the Phenomenon of Food Waste as Demonstrated by Students and Lecturers of PULS

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Abstract: The article aims to compare various aspects of food waste in the context of rational food management using the example of two groups: students and employees of Poznań University of Life Sciences (PULS). The survey was conducted on the current level of food wastage in the households of students and employees of PULS, involving 266 respondents, including 187 students (N_1) and 79 employees (N_2). The conducted research and analysis of the obtained results showed the differences between younger and older people in relation to proper food storage, appropriate use of food surplus, awareness of both consequences of food waste, and the existence of this problem is a consumer behavior. Both groups of surveyed consumers waste food, but students waste it more frequently and in larger quantities than the employees. This situation resulted from different consumer habits and attitudes towards food waste. The research indicated that employees are more effective in reducing food waste in their own households through better use of leftovers.

Keywords: food management; food waste; Poland; young people; older people; leftovers

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Citation: Przezbórska-Skobiej, L.; Wiza, P.L. Food Waste in Households in Poland—Attitudes of Young and Older Consumers towards the Phenomenon of Food Waste as Demonstrated by Students and Lecturers of PULS. *Sustainability* **2021**, *13*, 3601. https://doi.org/10.3390/su13073601

Academic Editor: Claudia Giordano

Received: 1 February 2021
Accepted: 15 March 2021
Published: 24 March 2021

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1. Introduction

Food waste, with its many negative social, economic, and environmental effects [1–3], is becoming one of the key issues of the 21st century. According to the definition, wasted food is "food produced for human consumption that has not been consumed" [4] (p. 1). One of the classic definitions of food waste additionally indicates that it involves "any processed, partially processed, or unprocessed products intended for, or expected to be consumed by, humans, as well as the goods that, despite being produced, have not been consumed by people" [5] (p. 90). On the other hand, the Food and Agriculture Organization (FAO) points out in its publications that wasting food means the reduction in the mass of food in the final stages of the food chain, namely, distribution and consumption [6,7]. Food waste is also associated with excessive use of energy and water, which are required to produce, transport, and distribute food [2,8,9]. At the same time, in the world, there is observed an increase in the costs incurred for purchasing and preparation of meals, and with the growing amount of food thrown away, the problem of environmental pollution caused by the production of more waste is worsening [1,2].

The phenomena related to food loss or food waste can be observed at every stage of the supply chain, from agricultural production to the final consumption in households [6,10–12]. The causes of food loss and waste are mainly related to financial, management, and technical limitations of enterprises as well as the restrictions at the stage of obtaining food, storing, and warehousing [11–13]. Food waste is not only a missed opportunity to improve global food security [11,13], but also to mitigate the environmental impact and the use of resources from food chains [8,11,13–18].

While discussing the issue of food waste, two basic concepts of food loss and food waste can be distinguished, which relate to products that were originally intended for

human consumption but were thrown away or destroyed at any stage of the food chain—from the production process to a consumer [1,19]. In 2014, a team of FAO experts (High Level Panel of Experts; [11] distinguished two basic concepts. According to the definition, food loss refers to the primary production and processing of food raw materials as well as the loss caused by their turnover. On the other hand, food waste occurs at the final stages of the food chain, namely, during the distribution process and at the level of the end-consumer [11,20]. According to the data presented in scientific reports and in the reports issued by global organizations, most food is wasted in households [20–23]. This is a consequence of, among others, the lack of awareness among household members, especially in developed countries, about the amount of food wasted each day, as well as the negative impact of this phenomenon on the environment, society, and economy. In developed countries, the supply of food exceeds the demand, and the ongoing changes of the lifestyle of most modern consumers are directed towards consumerism and the excessive accumulation of material things [24].

According to Bilska et al. [25], scientific research of consumer behaviors in terms of food waste is less common than scientific research of the amount of food wasted. However, Bilska et al. [25] noticed that in recent years many studies have been published with a specific focus on consumer behavior, there is still a gap in research on household food waste. It should be noted that there is still space for theoretical and empirical studies, regarding different determinants and features of households and their members influencing food waste at the level of consumption.

Therefore, in the article, it was decided to use the research gap existing in the literature about not comparing different age consumers awareness of the phenomenon of food waste in one publication, as well as determining the causes and effects of wasting food in terms of age and education of respondents. The conducted and described studies can be a good supplement to the previously conducted research in the field of food waste and indicate how important social problem is the phenomenon of food waste. It was also indicated, based on the example of Poznań University of Life Sciences, what research centers can take to raise public awareness of food waste and to indicate how to proceed in accordance with the "zero waste" principle.

The paper is divided into five sections, including as follows: Section 1 introducing the problem of food waste, Section 2 covering literature review, Section 3 presenting the research design, Section 4 describing the main results obtained and, subsequently, Section 5 with the literature discussion and some conclusions.

2. Literature Review

Food is wasted or lost in the entire agrifood chain, from agricultural production, through postharvest treatment and storage, processing, distribution, and consumption, however, the problem of food waste in households is clearly deepening [6,10,26]. According to the data of FAO [20], approximately 1.3 billion tons of food is thrown away worldwide each year, which is one-third of the total food intended for human consumption [20]. In developed, higher-income countries, such as European countries, the biggest contribution to food waste are distribution and consumption, including households [8,16,27]. According to the results of the research carried out in 2020 by the Institute of Environmental Protection—National Research Institute and the Warsaw University of Life Sciences, as a part of the project entitled "Development of Monitoring System of Food Waste as well as Efficient Program of Rationalization and Reduction of Loss and Waste of Food" (so-called PROM project), it was shown that as much as 60%, or nearly 3 million tons, of food thrown away comes from households. Production and processing together account for 30% of the loss and waste [28]. In turn, the report presented by the European Commission [29] shows that approximately 100 million tons of food are wasted annually in Europe, 53% of which is household food waste. On average, approximately 20–30% of purchased food is thrown away in one European household, two-thirds of which would still be suitable for consumption [21,30–35]. In the UK, approximately 20% of food is wasted [30], while in the

US over 25–40% of food is thrown away [30]. In Poland, approximately 9 million tons of food are thrown into the bin per year [26,28], which means there was 54 kg of food waste per person/per year [32]. When compared to other parts of Europe, Poland ranks fifth in terms of food waste, just behind the UK, Germany, France, and the Netherlands [22]. It is worth emphasizing that in Western countries the scale of food waste is higher in the case of households, while in Poland more food is wasted during the stage of the production process [4]. Nearly 92 kg of food is thrown away every second in all Polish households. This shows how important it is to be responsible for the wastage of food in households, and hence the awareness that food waste can be reduced with some effort. Members of households with more skills and experience in planning purchases, doing shopping according to the list, and preparing planned meals waste less food [28].

The phenomenon of food waste at the household level can vary depending on the people living there, in particular their age and habits. As reported by Aschemann-Witzel et al. [23], food management educational campaigns conducted at the end-consumer level can effectively contribute to reducing food waste if they target the most relevant consumer segments and address the issues related to the root causes of throwing away food. The authors point out that it is important not so much to identify the incorrect behavior of a given group of consumers in the aspect of food management, but, above all, to indicate the correct attitude which would be a model to follow [23,31–33]. Koivupuro et al. [33] pointed out many factors influencing food wasting in the households, including, e.g., size of the household, the gender of the persons responsible of grocery shopping, the frequency of buying discounted food products, but also found some factors with no clear correlation with food wasting, e.g., age of the oldest person in household; area, form, and type of residence; educational level and type of work of adults in the family; and shopping, food preparation, and eating habits. Bilska et al. [24] and Stancu et al. [27] also mentioned many factors determining on the one hand food expenditures and on the other hand food waste at the level of households, including socio-economic factors (income and prices, increase of welfare and the share of expenditures on food), cultural, psychological or behavioral (e.g., eating habits, food waste behavior, shopping frequency, attraction to the special offers), and demographic determinants (e.g., age, number of people in households). WRAP (Waste & Resources Action Program is a UK registered charity. Works with businesses, individuals and communities to achieve a circular economy by helping them reduce waste, develop sustainable products and use resources efficiently. The Waste and Resource Action Program) [30] acknowledges that, in reality, a combination of factors play a part in consumer attitude to food waste.

There are many reasons for reduction of food waste, but it is commonly seen as the best strategy in increasing food supply in the world, especially in the context of increasing population and feeding the world population [16,18,27]. In this context, the very disturbing fact is that many scientific studies show that the young consumers waste food more often than the older ones [24,25,33]. The recent studies from different countries highlighted generational differences in attitudes to food waste, and some of them reported that millennials are the worst culprits when it comes to throwing away food as they do not understand the value of the food [25,30].

On the other hand, one must remember that an important segment of consumers is the elderly group, the size of which is growing every year. According to the forecast of the World Health Organization (WHO), this number will increase from 739 million to 2 billion from 2009 to 2050, respectively [35]. According to the estimations of Statistics Poland [36], by 2050 there will be a decrease in the number of children, while the number of elderly people will increase. According to those projections, in 2030, every third Polish person will be at the age of 60 or older, and in 2050, seniors will constitute 47% of the entire society [3]. Such a demographic trend brings in many changes to the level of social life, relating to, among others, the pension scheme, care for seniors, or the shortage of young, working people [37]. The general characterization of the group of elderly consumers is a major issue. Seniors differ not only in age, but also in the level of professional activity, material

situation, level of independence, psychophysical conditions, or interests and views [37]. The age limit, which could be considered as the beginning of old age, is a matter of debate. According to WHO, it is 60 years or more. English anthropologists suggest the age of 50, German—60, and American—75 [37]. On the other hand, the beginning of old age can be considered the end of a professional career and retirement, i.e., the age limit set by law in a specific country [37]. In terms of physiology, however, old age is understood as a biological phenomenon related to a decrease in physical endurance, deterioration of memory, vision, and other senses, or menopause and andropause [38]. Elderly adults often do not associate health deterioration with poor eating habits but only with age [39]. According to Jörissen et al. [40], many studies were concluded that older consumers, especially consumers aged 65 and over, waste significantly less food than the other groups of the population; however, there are also some concluding the opposite observation.

3. Materials and Methods

The article aimed to compare various aspects of food waste in the context of rational food management using the example of two groups: students and employees of Poznań University of Life Sciences (PULS). To achieve the assumed goal, a survey was conducted on the current level of food wastage in the households of students and employees of PULS. The research was conducted in the period between December 2019 and April 2020. The study involved 266 respondents, including 187 students (N1) and 79 employees (N_2) PULS.

Food wastage is a broad area to study. Research on food losses and food wastage faces significant barriers, such as: the lack of consistent definitions of the analyzed phenomenon, insufficient research methodologies, and the lack of data availability in the economic documentation of enterprises and institutions, and in national statistics. This hinders the research processes and comparative analyzes on a global scale, limits the possibility of monitoring these phenomena for the purposes of economic, administrative, national statistics, and process management [28]. The research results obtained and described in the article may be subject to some errors, due to difficulties in obtaining data, especially in the period from March to April 2020, which was caused by the epidemiological situation in Poland related to the Covid-19 pandemic; although the questionnaire was made available using the online form, not all respondents to whom the survey was directed sent their answers. This resulted in the reduction of the research sample from the planned number of 300 respondents to the final sample of 266 respondents.

The survey form consisted of two parts, including 9 metric questions (demographic and social characteristics) and 21 substantive questions related to buying, preparing, storing, and wasting food in households. The survey included both single-choice and multiple-choice questions, as well as open-ended questions. The results of the study are presented in numerical form, with the use of tables. A descriptive method with elements of descriptive statistics was used to analyze the obtained results. The statistical analysis was conducted using Statistica 13 software (StatSoft). A non-parametric tool was used, the chi-squared (χ^2) test of independence, to analyze the relationship between the surveyed groups of respondents and their opinions on the questions posed. The test was performed at $p \leq 0.05$.

The test of independence was performed to study the relationship between two nominal variables X and Y. In the considered population, there are disjoint variants distinguished for each trait (Xi, Yj), which means that we can divide the population into r disjoint subsets according to the variants of trait X and into s disjoint subsets according to the variants of trait Y. The distribution of the sample in the population is presented in Figure 1.

When: $\forall$i, j:nij ≥ 8, nij—quantity.

We can present the formula of the test as follows:

Hypothesis 1 (H1). *The variables X, Y are independent.*

Hypothesis 2 (H2). *The variables X, Y are dependent.*

$$\chi^2 = \sum_{j=1}^{s} \sum_{i=1}^{r} \frac{(n_{ij} - np_{ij})^2}{np_{ij}} \quad (1)$$

where:

$$p_{ij} = p_i\, p_j, p_i = \frac{n_i}{n}, p_j = \frac{n_j}{n} \quad (2)$$

$\chi^2 \geq \chi^2\, \alpha$, $(r-1)(s-1) \Rightarrow$ the null Hypothesis H1 is rejected in favor of the Hypothesis H2,

$\chi^2 < \chi^2\alpha$, $(r-1)(s-1) \Rightarrow$ there is no reason to reject the Hypothesis H2.

When the Hypothesis H1 is rejected, Pearson's contingency coefficient C can be calculated:

$$C = \sqrt{\frac{\chi^2}{\chi^2 + n}} \quad (3)$$

DESCRIPTION		VARIABLES Y			QUANTITY
		Y_1	Y_2	Y_s	$\sum_{j=1}^{s} n_{ij} = n_j$
Variables X	X_1	n_{11}	n_{12}	n_{1s}	n_i
	X_2	n_{21}	n_{22}	n_{2s}	n_2
	X_r	n_{r1}	n_{r2}	n_{rs}	n_r
	$\sum_{i=1}^{r} n_{ij} = n_j$	n_1	n_2	n_s	$\sum_{j=1}^{s}\sum_{i=1}^{r} n_{ij} = n$

Figure 1. Distribution of the sample from the population. Source: [41].

This measure determines the strength of the relationship between the two variables analyzed with the chi-squared test.

The data obtained from the study were further analyzed based on the responses of the groups concerned and then compared with each other. Then, the results were cross-referenced with data from literature sources relating to the studies on food waste conducted in other research centers, and, based on that, final conclusions were prepared.

4. Results

4.1. Socio-Demographic Characteristics of the Surveyed Population of Respondents

The studied sample consisted of two groups of respondents: 187 students (N_1) and 79 employees (N_2) of Poznań University of Life Sciences (Table 1). The survey aimed to investigate the phenomenon of food waste in Polish households, taking into account the specific characteristics of the two research groups.

Table 1. Characteristics of sex, age, and place of residence of the surveyed group of respondents (% of total respondents in the group of students or in the group of employees).

Characteristics of the Respondents	Description	Students $N_1 = 187$	Employees $N_2 = 79$
Sex	Female	72.7	69.6
	Male	27.3	30.4
Age	19–26 years	100.0	3.8
	27–35 years	0.0	24.1
	36–50 years	0.0	46.8
	more than 50 years	0.0	25.3
Place of residence	Village	26.2	20.3
	City up to 10,000 residents	10.2	2.5
	City from 10,000 up to 50,000 residents	19.8	6.3
	City from 50,000 up to 100,000 residents	7.0	6.3
	City from 100,000 up to 500,000 residents	10.7	7.6
	City over 500,000 residents	26.2	57.0
Education	Basic	0.0	0.0
	Medium	69.0	3.8
	Higher (1st degree)	30.5	2.5
	Higher (2nd degree)	0.5	27.8
	Higher (3rd degree)	0.0	65.8
Professional status	Student	98.4	2.5
	Employment in non-manual labor	0.0	86.1
	Employment in manual labor	0.5	2.5
	Self-employment	1.1	5.1
	Farmer	0.0	0.0
	Pensioner	0.0	3.8
	Unemployed	0.0	0.0
Family status	Single	79.7	12.7
	Married without children	3.2	25.3
	Married with children	2.1	62.0
	Stable relationship	14.4	0.0
	Single mother	0.5	0.0
Expenditure on food purchases (PLN/weekly purchases)	Up to 100	8.6	1.3
	101–200	40.1	25.3
	201–300	35.8	34.2
	301–400	11.2	27.8
	401–500	2.1	11.4
	Over 500	2.1	0.0

Source: Own study.

In both groups, the majority of the respondents were women (among students, almost 73% of the total number were females, and among the employees of the university, almost 70% of the total number). All students belonged to the age group of 19–26, while there was greater age diversity observed among the employees. Nearly 47% of the persons were

at the age of 36–50, and in the case of the other two larger groups, the respondents were aged 27–35 and over 50 years old (24% and 25% of all the employees, respectively). The surveyed groups of respondents (both the students and the employees) declared that they lived in a city of over 500,000 residents (mainly Poznań) (26.2% of the students, 57.0% of the employees) or in the rural areas (26.2% of the students, 20.3% of the employees). Significant differences between the studied groups could be observed when the family statuses of the respondents were analyzed. While the majority of students were single (79% of all surveyed students) or lived in unofficial relationships, over 87% of all surveyed employees had a spouse. The majority of the surveyed students lived in four- and three-person households.

4.2. Behaviour Related to Food Purchasing and Estimation of Food Expenditures in Households

In this section of the project, there is a presentation of the eating behavior of the respondents and the estimated food expenditure by a household, the aim of which is to determine the attitude of persons towards food. Based on the research, it was found that the majority of the students (67% of the respondents) lived in their households with their parents, and the remaining part of the group of students indicated in the survey that they had their own place. In the case of the employees, the opposite was observed, almost 90% of the respondents had their own place of residence, which is justified since most of the employees were over 26 years old, and age is one of the factors determining the moment of leaving the family home. Shopping is the responsibility of different members of the household and it often depends on the size and the structure of the household. Based on the information from the survey presented above, it can be stated that a significant number of students live in households with their parents or other persons. In this case, the people who are responsible for shopping are those who are most often in charge of managing the meals in the group, i.e., parents, older siblings, etc. The employees declared that it was most often them, or another person such as a spouse, who was responsible for shopping in their households (over 49% of the surveyed employees). Referring to the previous conclusion, the particular results can be explained by the age of the surveyed employees, the fact that they were older, and that they most often lived with their own family or alone. In the case of weekly expenditure on grocery shopping, more than three-quarters of the students and the employees spend less than PLN 300 a week. The distribution of the expenses in the two other groups of the respondents is analogous to the average net income per person, but one can notice here the validity of the theory of Engel's law, according to which the share of food in the total expenditures decreases as the income of the consumer increases. The larger amount of spending on food by the employees is most likely related to purchasing higher quality and luxury items rather than buying more basic goods (Table 2).

One of the ways of rationalisation of food management is to buy only the required products in the right quantities. A simple tool can be used for this purpose—a shopping list prepared thoughtfully and according to the planned menu. In the first question of the survey, the respondents were asked whether they created a list of products based on which they could do shopping. Based on Table 2, it can be concluded that the majority of the students and the employees use the shopping list prepared in advance. There are minor differences between the responses in the two groups; however, there is a relatively greater tendency in the case of the students not to use the list of products.

The second question required the respondents to answer whether they checked what products they had at home before they went shopping. Both the students and the employees (approximately 80% of the respondents in the two groups) declared that they checked what products they had at home before going shopping (Table 2). The conducted study has proved that the type of research group is not a factor that differentiates the behaviour of the respondents in the discussed aspect [42–44], similarly to age in the case of the research performed by Bilska et al. [25] on a sample of 1115 adult respondents (aged 18 or more), where it was revealed that only 4 out of 10 adult respondents stated that they "always" or "usually" checked the contents of their cupboards and refrigerators at their households and prepared a list of necessary grocery products before they went shopping.

Table 2. Assessment of shopping habits of the respondents using a 5-point Likert scale, from 1 = completely disagree to 5 = fully agree (% of the respondents in a given group).

Description	Study Groups	I Do Not Agree	Hard to Say	I Agree
		% of Respondents in the Surveyed Group		
Grocery shopping with a list of the products you need	students	20.3	14.4	65.2
	employees	15.2	15.2	69.6
Before going shopping, it is checked what products are at home	students	8.0	10.2	81.8
	employees	12.7	7.6	79.7
Checking the expiry date of food products in the shop	students	6.4	18.2	75.4
	employees	11.4	11.4	77.2
Buying products with an expiration date so short that they have to be thrown away	students	47.6	25.1	27.3
	employees	69.6	11.4	19.0
Shopping for some time in advance (e.g., for a week) and before using everything, some products are already spoiled	students	39	23.5	37.4
	employees	51.9	31.6	16.5
Shopping in the spur of the moment, when we feel hungry, we want a particular product	students	8.0	4.8	87.2
	employees	35.4	22.8	41.8

Number of students N_1 = 187, number of employees N_2 = 79. Source: Own study based on the conducted research.

In the next question, the respondents were asked to state whether they checked the expiration dates of the products they were purchasing while shopping. In this case, again, the majority of the respondents from both groups (approximately 76 respondents in each group) agreed with that statement. The respondents of the surveyed groups were also asked if it occurred to them to do shopping some time in advance, which meant that some products could expire by the time they were used. More than half of the employees disagreed with that statement, and 30% were not sure. In the group of students, however, it can be observed that approximately 39% of the respondents agree with that statement, while 37.4% of the respondents disagree with it, which demonstrates that students tend to make smaller purchases and larger ones as well, which may be dictated by the comfort and good mobility of individual persons. The largest discrepancies in the answers can be noticed in the sixth question which concerned the phenomenon of making impulse purchases (following cravings, experiencing feeling of hunger while shopping, etc.) Nearly 90% of the surveyed students said they agreed with the quoted phrase, contrary to the employees, where fewer than half of them chose a similar response. Based on the above results, it can be concluded that students and employees generally have similar shopping habits; however, students seem to have a more emotional approach to purchasing goods (self-indulgence, shopping when hungry) (Table 2).

4.3. Food Waste in Households

More than 80% of the surveyed students and 77% of employees admitted to wasting food in their households (Table 3). When confronted with the results of FPFB surveys conducted in 2013 and 2015 [38,40], in which 39% and 60% of Polish respondents, respectively, admitted to throwing away food, the declarations of the surveyed students put them in a very unfavorable light. However, the results of our own survey are consistent with the results of the survey involving households in Olsztyn and Warsaw, which was conducted on a sample of 600 respondents, 81% of whom admitted that they sometimes threw away food. In that survey, significantly more respondents from Warsaw than from Olsztyn admitted to food waste [45]. Based on the chi-squared test, the obtained results were found to be statistically significant, as χ^2 (calculated) equal to 4.797 is higher than χ^2 (tabulated) of 5.991, which indicates the lack of significant differences in the declarations of the study groups regarding the stages of food waste in households (Table 3).

Table 3. Declarations about food waste in households (% of respondents from each group: employees/students).

Food Waste in the Household	Students $N_1 = 187$	Employees $N_2 = 79$	Chi-Squared Test
Yes	84.49	77.22	$p = 0.909146$ χ^2 (calculated) = 4.797012 χ^2 (tabular) = 5.991
No	10.70	20.25	
I do not know	4.81	2.53	

Source: Own study based on the conducted research.

Almost half of the surveyed students and employees threw away food several times a week, however, the percentage share of employees was lower. Among PULS students and employees, the second most common response regarding throwing away food was "once a week", where the percentage share of students was also higher (20.3% and 16.5%, respectively). Based on the chi-squared test, the results obtained were found to be statistically significant, as χ^2 (calculated) equal to 24.419 is higher than χ^2 (tabulated) of 15.507, which indicates statistically significant correlations in the declarations of both groups regarding the frequency of food waste in households. Moreover, only 2% of the surveyed students and 12% of employees stated that they did not throw away food at all (Table 4).

Table 4. Frequency of food waste in households.

The Frequency of Food Waste in Households	Students $N_1 = 187$	Employees $N_2 = 79$	Chi-Squared Test
	% of Respondents in a Given Group (Employees/Students)		
Food is not thrown away	2.1	12.7	$p = 0.998052$ χ^2 (calculated) = 24.41945 χ^2 (tabular) = 15.507
Once every few months	9.6	6.3	
Once a month	10.2	16.5	
Several times a month	7.5	10.1	
Once every few weeks	1.1	0.0	
Every two weeks	2.7	7.6	
Once a week	20.3	16.5	
A few times a week	42.2	29.1	
Daily	4.3	1.3	

Source: Own study based on the conducted research.

The respondents were asked at what stage of food management the largest amounts of food were wasted in their households. More than one-third of students reported that the largest amounts of food were thrown away in their households as a result of its storage (possible lack of knowledge on how to store food or purchasing too-large amounts of food). More than 50% of students believe that kitchen leftovers and plate ones were the main cause of food waste. On the other hand, in employee households, food waste most frequently occurred at the stage of food storage (Table 5). Based on the chi-squared test, the obtained results were found to be statistically significant, as χ^2 (calculated) equal to 24.419 is higher than χ^2 (tabulated) of 15.507, which indicates significant differences in the declarations of the study groups regarding the stages of food waste in households.

As an addition to the survey, the respondents were asked if food surplus was used in their households and how it was managed. There were significant differences between responses of the study groups. The largest number of students (approximately 35% of all surveyed students) used food surplus for feeding their pets. The second largest group of students used surplus food for preparing new meals. Regarding the employees, food surplus is most frequently used for preparing new meals (41% of surveyed employees) and homemade preserves (26%). To obtain a more complete picture regarding the groups of

wasted food products, the students and the employees participating in the survey were asked about food products that were most frequently wasted by them. Almost 70% of the surveyed students admitted that bread was the most frequently wasted product by them. Fruit was the second most common response (47% of total students' respondents), followed by vegetables (42%), cold meats (31%), and yoghurt (25%). There were no large differences in the survey results between those both groups (students and employees); however, some discrepancies among individual product groups might be noted. Employees were less likely than students to report that they occasionally threw away bread (49%). There was also less wastage of cold meats in that study group, although the differences were not as large as in the bread group. As in previous analyses, it was found that employees have a greater aversion to food waste in general, which is evidenced by the difference in response results between the group of employees and the group of students (11% and only 4% respectively). The least frequently selected (by both groups) responses concerning wasted food products included sweets, eggs, and fish.

Table 5. Food waste at different stages of food management.

Food Waste at Different Stages of its Preparation for Consumption	Students $N_1 = 187$	Employees $N_2 = 79$	Chi-Squared Test
Food storage	34.2	51.9	$p = 0.999730$ χ^2 (calculated) = 19.02247 χ^2 (tabular) = 7.815
Peparing of meals	13.4	5.1	
Kitchen and plate leftovers	51.9	36.7	
Food is not thrown away	0.5	6.3	

Source: Own study based on the conducted research.

4.4. Causes of Food Waste in Households

In efforts to rationalize behavior related to consumer food management it is essential to understand the causes of food waste. According to PULS students, based on the conducted survey, the most common causes of food waste in households are too-large meal portions (27.3%), food spoilage due to too-long storage (24.6%), overlooking of the expiry date (22.5%). Among PULS employees, however, the most common responses were food spoilage due to too-long storage (25.3%), the purchase of too-large amounts of food (24.1%), and preparing too-large meal portions (19.0%) (Table 6).

Table 6. Reasons for throwing food away in the households of surveyed PULS employees and students (% of respondents from each surveyed group: employees/students).

Description	Study Groups	Very Rarely/ Never/Sporadically	Sometimes/ Quite Often	Always/Very Often + Often
		% of Respondents in the Surveyed Group		
Buying too much food	Students	67.9	19.8	12.3
	Employees	62.0	13.9	24.1
Buying food without a shopping list	Students	60.4	21.9	17.6
	Employees	65.8	25.3	8.9
Purchase of unnecessary products under the influence of marketing tricks (e.g., promotional price, multipacks)	Students	55.6	26.2	18.2
	Employees	68.4	17.7	13.9
No idea for using the purchased products	Students	62.6	25.7	11.8
	Employees	81.0	12.7	6.3
Preparing too-large meal portions	Students	43.9	28.9	27.3
	Employees	55.7	25.3	19.0

Table 6. *Cont.*

Description	Study Groups	Very Rarely/ Never/Sporadically	Sometimes/ Quite Often	Always/Very Often + Often
		% of Respondents in the Surveyed Group		
Storing food in inappropriate conditions	Students	67.9	20.9	11.2
	Employees	79.7	10.1	10.1
Exceeding of the expiry date	Students	49.7	27.8	22.5
	Employees	54.4	27.8	17.7
Bad quality of purchased products	Students	70.6	22.5	7.0
	Employees	82.3	11.4	6.3
Food spoilage due to over-storage	Students	47.1	28.3	24.6
	Employees	51.9	22.8	25.3
The belief that food is cheap and therefore easy to throw away	Students	81.3	12.8	5.9
	Employees	97.5	1.3	1.3

Source: Own study based on the conducted research.

The respondents were asked to estimate the amount of money lost on average per week due to throwing away food. In the obtained results (based on the chi-squared test), there were statistically significant correlations between the study groups and the obtained responses (Table 6). According to both groups, students (57.2% of respondents) and employees (74.7%), they lose approximately 15% of their money per week due to food waste. In 23% of the households represented by students, the value of wasted food was up to 30% of the value of the food products purchased. The same value of wasted money was stated by only less than 9% of the surveyed employees. Higher values were selected only occasionally or not at all. More than 15% of employees, however, could not identify the actual value of the food being thrown away (Table 7).

Table 7. Amount of money lost on average per week due to food waste

Amount of Money Lost Due to Food Waste Per Week (as % of the Total Value of Food Purchases)	Students $N_1 = 187$	Employees $N_2 = 79$	Chi-Squared Test
I do not waste/throw away food	8.0	1.3	$p = 0.989726$ χ^2 (calculated) = 18.404 χ^2 (tabular) = 14.067
0–15% of the purchase value	57.2	74.7	
16–30% of the purchase value	23.5	8.9	
31–45% of the value of purchases	1.6	0.0	
46–60% of the value of purchases	1.1	0.0	
61–75% of the value of purchases	0.5	0.0	
Above 75%	0.0	0.0	
I have no opinion/cannot define	8.0	15.2	

Source: Own study based on the conducted research.

4.5. The Effects of Household Food Waste and Recommendations for the Future (Noticing the Food Waste Problem and Its Consequences)

Food waste is a phenomenon that carries many negative consequences for society, environment, and global economies. Based on its various manifestations, 12 statements were formulated by means of which the respondents' attitude towards a given problem was analyzed. For this purpose, a 5-point Likert scale was used (1—the statement is completely unimportant, 2—the statement is unimportant, 3—it is difficult to say whether the statement is important or unimportant, 4—the statement is important, 5—the statement is very important). For most of the analyzed statements, no significant differences were noted between the ratings of students and employees. More variation in responses was

only observed for high food prices and their fluctuations—a greater number of students than employees considered those problems important (Table 8).

Table 8. Assessment of the consequences of food waste (% of respondents from each group: employees/students).

Statements	Study Groups	Totally Unimportant + Never Mind	Hard to Say	Important + Very Important
		% of Respondents in the Surveyed Group		
Waste of your own money	students	7.0	7.5	85.6
	employees	2.5	5.1	92.4
High food prices	students	7.5	23.5	69.0
	employees	29.1	20.3	50.6
Fluctuating food prices	students	7.5	41.2	51.3
	employees	32.9	31.6	35.4
The occurrence of hunger and malnutrition	students	5.9	10.7	83.4
	employees	8.9	10.1	81.0
Reduced food availability	students	16.0	33.2	50.8
	employees	16.5	26.6	57.0
Less food offered	students	18.7	43.9	37.4
	employees	40.5	26.6	32.9
Waste of raw materials, energy, water, etc. consumed in the production and supply of food	students	7.5	16.6	75.9
	employees	2.5	12.7	84.8
Redundant use of farmland and water resources	students	5.9	23.0	71.1
	employees	10.1	20.3	69.6
Increasing greenhouse gas emissions	students	11.2	22.5	66.3
	employees	7.6	21.5	70.9
Wasting human labor	students	8.0	20.3	71.7
	employees	5.1	17.7	77.2
Losses in the country's economy	students	11.8	25.1	63.1
	employees	8.9	26.6	64.6
Necessity to liquidate/utilise wasted	students	9.1	17.6	73.3
	employees	3.8	13.9	82.3

Number of students N_1 = 187, number of employees N_2 = 79. Source: Own study based on the conducted research.

The examples of the consequences of food waste were discussed by their type (economic, environmental, and social consequences). For the respondents, environmental consequences were of the greatest importance. This is evidenced by the fact that the number of respondents rating the consequence in question as important and very important was not lower than 60% of the total group. The environmental consequences of food waste belong to a category of consequences that were assessed quite homogeneously. This provides evidence of the knowledge of both groups participating in the survey regarding the extent of the negative impact of food waste on the environment. This is a result of growing environmental awareness of society as a whole and various social programs aimed at changing everyday habits to "greener" ones. A fairly large variation in ratings was observed in the group of questions concerning economic and social consequences. In the whole surveyed group, 88% of respondents rated the loss of their own money as an important consequence of food waste, but only 43% responded in the same way regarding food price fluctuations. Such differences can also be observed in mean scores obtained. However, these results should come as no surprise, as consumers are primarily focused on personal financial losses (Table 8).

A similar distribution of ratings was observed in questions concerning the social consequences. The phenomenon of global hunger and malnutrition has always been

the greatest challenge facing food safety. Moreover, in addition to the problem of the availability of safe food, hunger among the poorest seems to be an immoral and unethical phenomenon in relation to the amount of wasted food. These moral dilemmas were reflected in our own research, in which over 80% of respondents rated the problem of hunger and malnutrition as an important consequence of food waste. Wastage of human labor was assessed as an important consequence of food waste by approximately 70% of respondents, whereas reduced food offer was rated as a more insignificant one (Table 8). An important step towards combating food waste and minimizing food waste is to take various measures to raise consumer awareness.

5. Discussion and Conclusions

The results of the research in most areas are comparable with the results of the survey conducted by other authors, e.g., Bilali et al. [42] on a sample of 122 Moroccan households. It was found that 12% of the surveyed households did not waste food while 26% threw away food several times a week. The food waste process is influenced by a group of consumer attitudes and behaviors that have an impact on how household representatives manage the planning and implementation of purchases, preparation of meals, and consumption [27,43]. Other authors [27,46–48] indicate that household practices related to meal planning and preparation play a key role in food waste generation. Households wasted less food if their members had more skills and experience [49]. The frequency of food waste is correlated with the ability to prepare meals and reuse leftovers, as well as the regularity of meals in the household, as evidenced by the New South Wales Environment Protection Authority (NSW-EPA) survey [34]. Half of the Australian respondents stated that all household members ate a main meal 5–7 times per week, while 40% of respondents prepared meals on their own in the household [34,50].

The results of the survey regarding food products wasted confirmed the 2018 FPFB [51] survey conducted on a random sample of Poles, in which the majority of consumers also indicated bread, fruit, vegetables, and cold meats as the most frequently wasted food products. At the same time, the 2017 survey [44,51] showed that cold meats (49% of all respondents) and potatoes (16%) were the second most frequently thrown away group of food products [51]. The most common choice of the food groups concerned seems logical. Bread, vegetables, and cold meats are products that are consumed by many Poles, and their relatively short shelf life may lead to throwing them away more frequently. On the other hand, products that are used less frequently or have a longer expiry date (e.g., sweets) are rarely wasted.

It was found that the study of students and employees of PULS overlaps with other surveys [40,52–59], where the most common causes of food waste among respondents included too long food storage, improper food storage and too large meal portions. In Finnish households, the causes of food waste were found to be food spoilage (29%), exceeding of the expiry date (19%), leftovers (14%), or preparing too-large amounts of food (13%) [53]. According to WRAP [30] and Koivupuro et al. [33], phenomena such as food spoilage, leftovers, or overlooking of an expiry date are preventable. Farr-Wharton et al. [54] emphasize that knowledge of household food resources is crucial to prevent the purchase of unnecessary food products. According to Parizeau et al. [55] and Secondi et al. [56], careful grocery planning is an effective tool to prevent food waste. Quested et al. [43] showed that there was a strong positive correlation between creating a shopping list and other consumer behaviors such as planning meals in advance and checking food supplies before shopping.

According to the report of the Federation of Polish Food Banks (FPFB), over 60% of Poles admit that they do not go shopping with a list of necessary products. This means that the shopping habits of the surveyed group of students and employees of the university were fundamentally different from those of a statistical Polish person [57,58]. The conducted research was also compared with the study performed by Zabłocka et al. [59] among a group of respondents representing Polish and Swedish students (with a sample of 234

students, 132 of whom were Polish students while 102 students came from Sweden). The research conducted by Zabłocka [59] revealed that 41% of Polish students and 51% of Swedish students always bought food using a prepared list of products they needed. A more favorable result of the particular study for this project may be associated with the need for more careful planning of shopping and control of expenses by the students and the employees of PULS trying to manage their budget wisely. Skilful planning of food purchases and the use of products in accordance with the needs should be one of the commandments of the decalogue of a sensible consumer [60]. Meanwhile, according to a pan-European survey, out of the six suggested types of behavior that would be helpful to reduce food waste, the largest number of Polish consumers, 70%, indicated more organised shopping and better planning of home meals [61].

The research conducted by Tomaszewska et al. [62] proved that younger consumers are more likely to purchase random products than older persons. In contrast, consumers living in cities of over 500,000 residents are more likely to buy food in advance than the inhabitants of rural areas. Based on the study, it was found that one in five respondents declared that they always or usually purchased products that they did not plan to buy while shopping. The behavior of consumers in a store, especially the fact that they buy more food than necessary, is a major reason for food waste [63–65]. Overbuying is caused by the marketing and sales strategies implemented by food producers and distributors [66]. The outcomes of the research show that the implemented communication strategies, as well as promotional offers, have a negative impact on food waste in households, prompting the customers to buy more products than they actually need [67,68].

Regarding causes of food waste in Polish households, most available studies indicate a strong correlation between the amount of wasted food and household size. The absolute amount of wasted food strongly depends on the number of individuals per household; smaller households tend to produce less waste than larger ones, however, their amount of food waste per capita decreases as household size increases. Single-person households waste the most food per capita [40].

According to a survey conducted by FPFB [51], it can be concluded that 85% of Poles are aware that food waste is associated with high costs, 71% of Poles state that throwing away food has a negative impact on the environment, and 83% of the respondents believe that food waste is a social issue [51].

The conducted research and analysis of the obtained results led to the following statements and conclusions:

1. Proper food storage, appropriate use of food surplus, awareness of both the consequences of food waste and the existence of this problem is a consumer behavior that has a significant effect on the magnitude of food waste in households. Respecting of appropriate rules and an increase in consumer and public awareness can help reduce food waste.
2. Food waste was observed in both types of analyzed households, however, based on the conducted research, it can be concluded that students waste food more frequently and in larger quantities than PULS employees. This situation is related to different consumer habits and attitudes towards food waste. Students are more likely to have an emotional approach to shopping (cravings) and they purchase food products without any pre-prepared shopping list. Moreover, they often live alone or with friends and prepare meals just for themselves. This lifestyle may result in lower food expenditures; however, it also contributes to greater food waste (lack of ideas for the use of leftovers, a belief that food prices are low).
3. The research results indicate that employees are effective in reducing food waste in their own households through better use of leftovers (e.g., by making homemade preserves or preparing more meals). Besides, some older employees are likely to have eating habits that derive from the period of the controlled economy when food distribution was limited and consumers were more resourceful in preparing meals (use of whole food products and aversion to food waste).

4. Poland, as an economically developed country and a member of the EU, implements development goals, including sustainable consumption and production (SCP). On the one hand, there is an overproduction of food and its waste, however, the problem of malnutrition in the world is growing. Recent forecasts predicted a decline in the number of malnourished people worldwide, but this was changed by the Covid-19 pandemic. As Reiss-Andersen, the president of the Norwegian Nobel Committee, emphasized, announcing the World Food Program (WFP) as the 2020 Nobel Peace Prize Winner, "The coronavirus pandemic has caused more people to starve. The situation worsens [...], the combination of disease and hunger is particularly dangerous" [28].
5. Food waste also contributes to environmental pollution, degradation, and depletion of natural resources, threatening food safety. Therefore, halving the problem of food waste by 2030 is one of the 17 development goals of the United Nations. The European Union is trying to prevent food waste and reduce it by increasing the knowledge and awareness of consumers, various types of educational campaigns, and the correct redistribution of food and measurement of waste in EU countries. Due to the EU's obligation to reduce food losses and food waste by 50% by 2030, as well as to report the losses incurred, it is necessary to know the starting situation [28].
6. The research carried out and described in the article may contribute to making consumers aware of the essence of the problem of food waste, which may result in Polish households, based on participation in social campaigns organized, among others, by Poznań University of Life Sciences, having more knowledge in the field of rational waste management and undertaking activities in the field of purchasing planning and applying the "zero waste" principle.

It is worth underlining that in recent years, the activities of scientists from different faculties of Poznań University of Life Sciences have been aimed at the popularization of science both among the young and elderly population. These activities are also aimed at making the society aware of the phenomenon of food waste. For many years, scientists of PULS have been participating in events such as the European Researchers' Night and the Poznań Festival of Science and Art, which are aimed at the young generation. The aim of these events is to make the young population aware of the importance of the problem of food waste through workshops and lectures conducted by PULS scientists and to indicate how every young person can contribute to reducing waste by their behavior.

In 2021, Poznań University of Life Sciences decided to use social media, i.e., Facebook, to create a year-long information campaign entitled "In 2021 I will generate less waste", thanks to which PULS scientists will post materials throughout the year on how each family member will reduce waste in the household [69]. The aim of the campaign is to reach as many people as possible, regardless of age, to make society aware of the importance of the problem of food waste, and to encourage Poles to act in accordance with the "zero waste" principle. Researchers of Poznań University of Life Sciences encourage the recipients of the portal in short material to:

- produce less waste,
- reuse items that are suitable for this,
- give to others instead of throwing away,
- use resources, water, and electricity more wisely, so as not to waste them,
- buy locally,
- change the means of transport to a more ecological one,
- experience and not just consume [69].

In conclusion, food waste on the household level is a highly complex and multifaceted issue driven by a variety of consumer behaviors and their attitudes towards food waste. The paper aimed to compare various aspects of food waste in the context of rational food management using the example of two groups: students and employees of Poznań University of Life Sciences. The conducted research and analysis showed some similarities and differences between younger and older people in relation to proper food storage,

appropriate use of food surplus, awareness of both consequences of food waste, and the existence of this problem is a consumer behavior. This study may be treated as a basis for future broader analysis of food waste on the household level in Poland. The authors of the study are aware of the limitations of the questionnaire surveys as the method to detect household food waste, as they are heavily biased. According to the EC Common Methodology [70], diaries and waste compositional analysis are accepted by the European Union as the correct methods to detect household food waste. These methods may be used in the next step of the food waste survey.

Author Contributions: Conceptualization, L.P.-S. and P.L.W.; methodology, L.P.-S. and P.L.W.; formal analysis, L.P.-S. and P.L.W.; writing—original draft preparation, P.L.W. and L.P.-S.; writing—review and editing, L.P.-S. and P.L.W.; visualization, P.L.W.; supervision, L.P.-S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Faculty of Economics, Poznań University of Life Sciences.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: We would like to express our gratitude to our students of Economics who participated in data collection, especially to Marlena Magdalena Stawicka and Adam Pietrowicz.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Gustavsson, J.; Cederberg, C.; Sonnensson, U. Global Food Losses and Food Waste. In Proceedings of the Save Food Congress, Düseldorf, Germany, 16–17 May 2011. Available online: https://www.madr.ro/docs/ind-alimentara/risipa_alimentara/presentation_food_waste.pdf (accessed on 14 January 2021).
2. Papargyropoulu, E.; Lozano, R.; Steiinberger, J.K.; Wright, N.; bin Ujang, Z. The Food Waste Hierarchy as a Framework for the Management of Food Surplus and Food Waste. *J. Clean. Prod.* **2014**, *76*, 106–115. [CrossRef]
3. Enos, A.K. Assessing the Socio-Economic Impact of Food Waste among International Students. Faculty of Economics and Social Sciences Institute of Regional Economics and Rural Development, 2019, Szent István University in Gödöllő, Hungary. Available online: https://www.researchgate.net/publication/332353148_ASSESSING_THE_SOCIO-ECONOMIC_IMPACT_OF_FOOD_WASTE_AMONG_INTERNATIONAL_STUDENTS (accessed on 20 December 2020).
4. Murawska, A. Marnowanie żywności wspólny problem (Food Waste a Common Problem). Portal Informacyjny Uniwersytetu Technologiczno-Przyrodniczego im. Jana i Jędrzeja Śniadeckiego w Bydgoszczy, Bydgoszcz, Poland. 2019. Available online: https://www.utp.edu.pl/pl/portal/strefa-popularnonaukowa/1762-marnowanie-zywnosci-wspolny-problem (accessed on 21 November 2020). (In Polish).
5. Śmiechowska, M. Zrównoważona konsumpcja a marnotrawstwo żywności (Sustainable Food Consumption and Food Wasting). *Ann. Acad. Med. Gedan.* **2015**, *45*, 89–97. (In Polish)
6. Gustavsson, J.; Cederberg, C.; Sonesson, U.; van Otterdijk, R.; Meybeck, A. *Global Food Losses and Food Waste. Extent, Causes and Prevention*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2011. Available online: http://www.fao.org/3/a-i2697e.pdf (accessed on 14 January 2021).
7. Verghese, K.; Lewis, H.; Loskrey, S.; Williams, H. Packaging's Role in Minimizing Food Loss and Waste Across the Supply Chain. *Packag. Technol. Sci.* **2015**, *28*, 603–620. [CrossRef]
8. Parfitt, J.; Barthel, M.; Macnaughton, S. Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050. *Philos Trans R Soc Lond B* **2010**, *365*, 3065–3081. [CrossRef]
9. IFCO SYSTEM. Stopping Food Waste and Food Loss. 2020. Available online: https://www.ifco.com/pl/stopping-food-waste-and-food-loss/ (accessed on 10 January 2021).
10. Czarniawska, B.; Löfgren, O. *Coping with Excess. How Organizations, Communities and Individuals Manage Overflows*, 1st ed.; Edward Elgar Publishing Limited: Cheltenham, UK, 2014; pp. 217–236, ISBN 978-1782548577.
11. HLPE. *Food Losses and Waste in the Context of Sustainable Food Systems*; High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security: Rome, Italy, 2014. Available online: http://www.fao.org/3/a-i3901e.pdf (accessed on 12 December 2020).
12. FAO. *The Future of Food and Agriculture. Trends and Challenges*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2017; ISBN 978-92-5-109551-5. ISSN 2522-722X. Available online: http://www.fao.org/3/a-i6583e.pdf (accessed on 14 December 2020).

13. OECD/Food and Agriculture Organization of the United Nations. *OECD-FAO Agricultural Outlook 2015–2024*; OECD Publishing: Paris, France, 2015. Available online: http://dx.doi.org/10.1787/agr_outlook-2015-en (accessed on 14 December 2020).
14. Smil, V. Improving Efficiency and Reducing Waste in Our Food System. *Environ. Sci.* **2004**, *1*, 17–26. [CrossRef]
15. Hodges, R.J.; Buzby, J.C.; Bennett, B. Postharvest losses and waste in developed and less developed countries: Opportunities to improve resource use. *J. Agric. Sci.* **2010**, *149*, 37–45. [CrossRef]
16. Kummu, M.; De Moel, H.; Porkka, M.; Siebert, S.; Varis, O.; Ward, P.J. Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Sci. Total Environ.* **2012**, *438*, 477–489. [CrossRef]
17. Chapagain, A.; James, K. Accounting for the Impact of Food Waste on Water Resources and Climate Change. In *Food Industry Wastes. Assessment and Recuperation of Commodities*, 1st ed.; Kosseva, M.R., Webb, C., Eds.; Elsvier: Amsterdam, The Netherlands, 2013; pp. 217–236, ISBN 978-0-12-391921-2. [CrossRef]
18. FAO. Food Wstege Footprint: Impacts on Natural Resources. Available online: https://reliefweb.int/report/world/food-wastage-footprint-impacts-natural-resources (accessed on 29 December 2020).
19. Okazaki, W.K.; Turn, S.Q.; Flachsbart, P.G. Characterization of Food Waste Generators: A Hawaii Case Study. *Waste Manag.* **2008**, *28*, 2483–2494. [CrossRef] [PubMed]
20. FAO. The State of Food Security and Nutrition in the Word, Safe Guarding Against Economic Slowdowns and Downturns. 2019. Available online: http://www.fao.org/state-of-food-security-nutrition/en/ (accessed on 14 December 2020).
21. WRAP. *Household Food and Drink Waste in the UK*; Final Report; WRAP: Banbury, UK, 2012; ISBN 1-84405-430-6. Available online: https://www.wrap.org.uk/sites/files/wrap/Household_food_and_drink_waste_in_the_UK_-_report.pdf (accessed on 16 December 2020).
22. Bräutigam, K.-R.; Jörissen, J.; Preifer, C. The Extent of Food Waste Generation Across EU-27: Different Calcultion Methods and the Reliability of Their Results. *Waste Manag. Res.* **2014**, *32*, 683–694. [CrossRef] [PubMed]
23. Aschemann-Witzel, J.; Giménez, A.; Grønhøj, A.; Ares, G. Avoiding Household Food Waste, One Step at a Time: The Role of self-efficacy, convenience orientation, and the good provider identity in distinct situational contexts. *JCA* **2019**, *54*, 581–606. [CrossRef]
24. Bilska, B.; Grzesińska, W.; Tomaszewska, M.; Rudziński, M. Marnotrawstwo żywności jako przykład nieefektywnego zarządzania w gospodarstwach domowych (Food Waste as an Example Inefficient Management in Households). *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu* **2015**, *17*, 39–43. (In Polish)
25. Bilska, B.; Tomaszewska, M.; Kołożyn-Ktajewska, D. Analysis of the Behaviours of Polish Consumers in Relation to Food Waste. *Sustainblity* **2020**, *12*, 304. [CrossRef]
26. Ślusarczyk, B.; Machowska, E. Food Waste in the World and in Poland. *АКАДЕМІЧНИЙ ОГЛЯД* **2019**, *1*, 91–99. [CrossRef]
27. Stancu, V.; Haugaard, P.; Lähteenmäki, L. Determinants of Consumer Food Waste Behaviour. Two Routes to Food Waste. *Appetite* **2016**, *96*, 7–17. [CrossRef] [PubMed]
28. Łaba, S.; Bilska, B.; Tomaszewska, M.; Łaba, R.; Szczepański, K.; Tul-Krzyszczuk, A.; Kosicka-Gębska, M.; Kołożyn-Krajewska, D. Próba oszacowania strat i marnotrawstwa żywności w Polsce (An Attempt to Estimate Food Loss and Waste in Poland). *Przem. Spoż.* **2019**, *74*, 10–18. [CrossRef]
29. FUSIONS. Estimates of European Food Waste Levels. Reducing Food Waste through Social Innovations. 2016. Available online: http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf (accessed on 12 December 2020).
30. WRAP. *Food Surpluses and Waste in the UK Key Facts*; WRAP: Banbury, UK, 2020; p. 16. Available online: https://wrap.org.uk/sites/files/wrap/Food-surplus-and-waste-in-the-UK-key-facts-Jan-2020.pdf (accessed on 16 December 2020).
31. Food Loss and Waste. U.S. Food and Drug Administration. 2020. Available online: https://www.fda.gov/food/consumers/food-loss-and-waste (accessed on 15 January 2021).
32. Monier, V.; Mudgal, S.; Escalon, V.; O'Connor, C.; Gibon, T.; Anderson, G.; Montoux, H. *Final Report—Preparatory Study on FoodWaste AcrossEU27*; European Commission BIO Intelligence Service: Brussels, Belgium, 2010. Available online: https://ec.europa.eu/environment/eussd/pdf/bio_foodwaste_report.pdf (accessed on 25 July 2017).
33. Koivupuro, H.-K.; Hartikainen, H.; Silvennoinen, K.; Katajajuuri, J.-M.; Heikintalo, N.; Reinikainen, A.; Jalkanen, L. Influence of socio-demographical, behavioural and attitudinal factors on the amount of avoidable food waste generated in Finnish households. *Int. J. Consum. Stud.* **2012**, *36*, 183–191. [CrossRef]
34. NSW-EPA. Food Waste Avoidance Benchmark Study, State of New South Wales (NSW) Environment Protection Authority(EPA), September 2012, Australia. Available online: http://www.frankston.vic.gov.au/files/34d7963e-24ab-455b-a1f5-a22300d89be2/Love_food_hate_waste.pdf (accessed on 12 November 2020).
35. Yannakoulia, M.; Mamalaki, E.; Anastasiou, C.A.; Mourtzi, N.; Lambrinoudaki, I.; Scarmeas, N. Eating habits and behaviors of older people: Where are we now and where should we go? *Maturitas* **2018**, *114*, 14–21. [CrossRef]
36. Department of Demographic and Labor Market Research: Statistics Poland. Population projection for 2014–2050. Statistical Publishing Department, Warsaw, Poland. Available online: https://stat.gov.pl/en/topics/population/population-projection/population-projection-2014-2050,2,5.html (accessed on 12 December 2020).
37. Kaniewska-Sęba, A. Polscy seniorzy wyzwanie dla marketingu w XXI wieku (Polish Seniors a Challenge for Marketing in the XXI Century). *Środkowoeuropejskie Studia Polit.* **2016**, *4*, 145–158. [CrossRef]

38. Tańska, M.; Babicz-Zielińska, E.; Przysławski, J. Attitudes of the elderly towards the issues of health and healthy food. *Probl. Hig. Epidemiol.* **2013**, *94*, 915–918.
39. Jeżewska-Zychowicz, M. *Zachowania żywieniowe Konsumentów a Proces Edukacji Żywieniowej (Nutritional Behaviour of Consumers and the Process of Nutritional Education)*; Wydawnictwo SGGW: Warsaw, Poland, 1996.
40. Jörissen, J.; Priefer, C.; Bräutigam, K.-R. Food Waste Generation at Household Level: Results of a Survey among Employees of Two European Research Centers in Italy and Germany. *Sustainability* **2015**, *7*, 2695–2715. [CrossRef]
41. Kukuła, K. *Elementy Statystyki w Zadaniach (Elements of Statistics in Tasks)*, 2nd ed.; Wydawnictwo Naukowe PWN: Warsaw, Poland, 2003; ISBN 978-83-01-16774-5. (In Polish)
42. Bilali, H.E.; Abouabdillah ACapone RYoussfi, L.E.; Debs, P.; Harraq, A.; Amrani, M.; Bottalico, F.; Driouech, N. Household Food Waste in Morocco: An Exploratory Survey. In Proceedings of the Sixth International Scientific Agricultural Symposium "Agrosym 2015", Jahorina, Bosnia, 15–18 October 2015; pp. 1353–1360. [CrossRef]
43. Quested, T.E.; Marsh, E.; Stunell, D.; Parry, A.D. Spaghetti Soup: The Complex World of Food Waste Behaviours. *Resour. Conserv. Recycl.* **2013**, *79*, 43–51. [CrossRef]
44. Banki Żywności Raport Nie Marnuj Jedzenia 2017. Wyniki Badania CAPIbus dla Federacji Polskich Banków Żywności). Available online: https://bzsos.pl/wp-content/uploads/2016/04/Nie-marnuj-jedzenia_2017.pdf (accessed on 29 January 2021). (In Polish).
45. Rejman, K.; Wrońska, J. Marnotrawstwo żywności w gospodarstwach domowych w kontekście rozwoju sfery konsumpcji (Food Waste in Households in the Context of the Development of the Consumption Sphere). In *Rolnictwo, Gospodarka Żywnościowa, Obszary Wiejskie 10 lat w Unii Europejskiej (Agriculture, Food Economy, Rural Areas 10 Years in the European Union)*, 1st ed.; Drejerska, N., Ed.; Wydawnictwo SGGW: Warsaw, Poland, 2014; pp. 97–110. (In Polish)
46. Porpino, G.; Parente, J.; Wansink, B. Food Waste Paradox: Antecedents of Food Disposal in Low Income Households. *Int. J. Consum. Stud.* **2015**, *39*, 619–629. [CrossRef]
47. Stefan, V.; Herpen, E.; Tudoran, A.A.; Lähteenmäki, L. Avoiding Food Waste by Romanian Consumers: The Importance of Planning and Shopping Routines. *Food Qual. Prefer.* **2013**, *28*, 375–381. [CrossRef]
48. Visschers, V.H.; Wickli, N.; Siegrist, M. Sorting out Food Waste Behaviour: A Survey on the Motivators and Barriers of Self-reported Amounts of Food Waste in Households. *J. Environ. Psychol.* **2016**, *45*, 66–78. [CrossRef]
49. Fami, H.S.; Aramyan, L.H.; Sijtsema, S.J.; Alambaigi, A. Determinants of Household Food Waste Behavior in Tehran City: A Structural Model. *Resour. Conserv. Recycl.* **2019**, *143*, 154–166. [CrossRef]
50. Bilali, H.E.; Yildirim, H.; Capone, R.; Karanlik, A.; Bottalico, F.; Debs, P. Food Wastage in Turkey: An Exploratory Survey on Household Food Waste. *JFNR* **2016**, *4*, 483–489. [CrossRef]
51. Banki Żywności. Marnując żywność, marnujesz planetę. Raport Federacji Polskich Banków Żywności. Nie Marnuję Jedzenia 2018. Available online: https://bankizywnosci.pl/wp-content/uploads/2018/10/Przewodnik-do-Raportu_FPBZ_-Nie-marnuj-jedzenia-2018.pdf (accessed on 29 January 2021). (In Polish)
52. Banki Żywności Raport FPBŻ Marnowanie żywności w Polsce i Europie 2012. Nie Marnuj Jedzenia. Available online: http://www.niemarnuje.pl/files/sdz_2012_10_16_raport_marnowanie_fpbz.pdf (accessed on 29 January 2021). (In Polish)
53. Silvennoinen, K.; Katajajuuri, J.M.; Hartikainen, H.; Jalkanen, L.; Reinikainen, A. Food Waste Volume and Composition in Finnish Households. *Br. Food J.* **2014**, *116*, 1058–1068. [CrossRef]
54. Farr-Wharton, G.; Foth, M.; Choi, J.H.J. Identifying factors that promote consumer behaviours causing expired domestic food waste. *J. Consum. Behav.* **2014**, *13*, 393–402. [CrossRef]
55. Parizeau, K.; von Massow, M.; Martin, R. Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste Manag.* **2015**, *35*, 207–217. [CrossRef] [PubMed]
56. Secondi, L.; Principato, L.; Laureti, T. Household Food Waste Behaviour in EU-27 Countries: A Multilevel Analysis. *Food Policy* **2015**, *56*, 25–40. [CrossRef]
57. Banki Żywności. Raport Federacji Polskich Banków Żywności. Zapobieganie Marnowaniu Żywności z Korzyścią dla Społeczeństwa, Dobroczynność bez VAT. 2013. Available online: https://www.food-law.pl/files/raport-zapobieganie-marnowania-zywnosci.pdf (accessed on 25 January 2021). (In Polish)
58. Banki Żywności. Raport Federacji Polskich Banków Żywności Nie Marnuj Jedzenia 2015. Marnowanie Jedzenia to Śmierdząca Sprawa. Available online: https://suwalki.bankizywnosci.pl/wp-content/uploads/2019/01/raport_niemarnuj_jedzenia_2015.pdf (accessed on 27 January 2021). (In Polish)
59. Zabłocka, K.; Rejman, K.; Prandota, A. Marnotrawstwo Żywności w kontekście racjonalnego gospodarowania nią w gospodarstwach domowych polskich i szwedzkich studentów (Food Waste in the Context of Rational Management in Households of Polish and Swedish students). Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego. *Ekon. Organ. Gospod. Żywnościowej* **2016**, *114*, 19–32. (In Polish)
60. Dąbrowska, A.; Janoś-Kresło, M. Marnowanie żywności jako problem społeczny (Food Waste as a Social Problem). *Handel Wewn.* **2013**, *4*, 14–25. (In Polish)
61. European Commission. *Flash Eurobarometer 425 'Food Waste and Date Marking', Fieldwork*; European Union: Brussels, Belgium, September 2015. Available online: https://data.europa.eu/euodp/pl/data/dataset/S2095_425_ENG (accessed on 20 January 2021).

62. Tomaszewska, M.; Bilska, B.; Kołożyn-Krajewska, D.; Piecek, M. Analiza przyczyn marnowania żywności w polskich gospodarstwach domowych (Analysis of the causes of food waste (In Polish) households). In *Straty i Problemy Marnowania Żywności w Polsce. Skala i Przyczyny Problemu (Food Losses and Problems in Poland. Scale and Causes of Problems)*, 1st ed.; Łaba, S., Ed.; Instytut Ochrony Środowiska Państwowy Instytut Badawczy: Warsaw, Poland, 2020; p. 132, ISBN 978-83-60312-68-1. (In Polish)
63. WRAP. Understanding Food Waste. In *Key Findings of our Recent Research on the Nature, Scale and Causes of Household Food Waste*; WRAP: Banbury, UK, 2007; p. 28, ISBN 1-84405-310-5. Available online: https://www.wrap.org.uk/sites/files/wrap/FoodWasteResearchSummaryFINALADP29_3__07.pdf (accessed on 16 December 2020).
64. WRAP. *The Food We Waste, Food Waste Report V2*; WRAP: Banbury, UK, 2008; p. 237, ISBN 1-84405-383-0. Available online: https://www.lefigaro.fr/assets/pdf/Etude%20gaspillage%20alimentaire%20UK2008.pdf (accessed on 16 December 2020).
65. Janssens, K.; Lambrechts, W.; van Osch, A.; Semeijn, J. How Consumer Behavior in Daily Food Provisioning Affects Food Waste at Household Level in The Netherlands. *Foods* **2019**, *8*, 428. [CrossRef] [PubMed]
66. Schanes, K.; Dobernig, K.; Gözet, B. Food waste matters—A Systematic Review of Household Food Waste Practices and Their Policy Implications. *J. Clean. Prod.* **2018**, *182*, 978–991. [CrossRef]
67. Mondéjar-Jiménez, J.A.; Ferrari, G.; Secondi, L.; Principato, L. From the Table to Waste: An Exploratory Study on Behavior Towards Food Waste of Spanish and Italian Youths. *J. Clean. Prod.* **2016**, *138*, 8–18. [CrossRef]
68. Bravi, L.; Francioni, B.; Murmura, F.; Savelli, E. Factors affecting household food waste among young consumers and actions to prevent it. A comparison among UK, Spain and Italy. *Res. Con. Rec.* **2020**, *153*, 104586. [CrossRef]
69. Zero Waste 2021. Available online: https://www.facebook.com/events/4204430559571782/?active_tab=discussion (accessed on 4 February 2021).
70. COMMISSION DELEGATED DECISION (EU) 2019/1597 of 3 May 2019 Supplementing Directive 2008/98/EC of the European Parliament and of the Council as Regards a Common Methodology and Minimum Quality Requirements for the Uniform Measurement of Levels of Food Waste. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D1597&from=en (accessed on 12 March 2021).