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SEGMENTATION OF HOUSEHOLDS TAKING INTO ACCOUNT THEIR STRUCTURE IN TERMS OF MEALS WASTE*

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Abstract

Not always do households manage purchased food efficiently, as evidenced by the scale of wasted food. As results from the PROM study on food waste, an average of 3.9 kg of food (including edible and inedible parts) was thrown away in a household per week. Understanding the determinants of household food waste is a key aspect to develop and implement education programs aimed at consumers. The aim of the study was to conduct segmentation and identify groups of consumers characterized by similar food handling, with particular emphasis on food waste. Segmentation conducted on a representative group of Poles over 18 years of age enabled the identification of five clusters. The identified groups of consumers differ in the following aspects: the number of adults, the number of children, a subjective assessment of the financial situation, the percentage of food expenses. It was found that cluster E, representing house-

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holds with children, prepared meals at home most often. At the same time, persons from this group most often threw out wilted fruit and vegetables, as well as potatoes, rice, and pasta. Cluster D, declaring high food expenses (61-100%), at the same time much less frequently, compared to the other groups, used meat from soup, cooked potatoes, rice, and pasta to prepare other dishes. Cluster C, declaring the best financial situation, significantly more often used wilted vegetables and fruit to prepare other dishes. Cluster A, with the largest share in the sample (almost 70%), often formed the so-called homogeneous groups with other clusters. However, it also threw away cooked starch additives and wilted fruit and vegetables more often. It should be stated that it is necessary to take measures to reduce food waste in households.

Keywords: food waste, cluster analysis, households, segmentation, nutritional practices.

JEL codes: E20, Q01, Q18.

Introduction

According to the definition by Statistics Poland, a household is a group of people living together in a housing unit and jointly maintaining themselves. Persons living alone and independently maintaining themselves constitute one-person households (Statistics Poland, 2002). According to M. Drymluch and B. Chorkowy (2009), the activity of households is primarily focused on meeting consumer needs. The most important factors determining the patterns of households include income, an important element of the standard of living, enabling meeting the basic needs and higher-order needs. The basic (lower-order) needs include food consumption, necessary for life and the proper functioning of the body. The level of household food expenditure is influenced by several cultural, psychological, social, demographic, and economic determinants. The most important ones include economic factors such as income and prices (Gałązka, 2013). As indicated by the Statistics Poland data from the past several years, expenditure on food and non-alcoholic beverages has had a significant share in the structure of expenditure of Polish households. In 2019, this share was 25.1% and was 3 percentage points lower than in 2004 (Statistics Poland, 2020). The level of food expenditure depends on the size of the household as well as belonging to a socio-economic group. Significant differences can be seen when analyzing average monthly equivalent expenditure[1] and food expenditure and non-alcoholic beverages in households by socio-economic groups and size. Families whose net outgoings are the lowest, at the same time spend the most on food and non-alcoholic beverages (pensioners – 19.1% vs. the self-employed – 11.6%). The highest net outgoings are noted for marriages without children and the lowest for marriages with three or more

[1] Net outgoings are all values flowing out of the household to the outside world, excluding personal income tax prepayments made on behalf of a tax payer by tax remitter and social security and health insurance premiums. Net receipts consist of expenditures and savings items on the outgoing side (Statistics Poland, 2020).

children. At the same time, the percentage share of expenditure on food and non-alcoholic beverages is the highest in multi-person families (14.4%) and the lowest in the case of married couples with one child (11.8%) (Statistics Poland, 2020). Each household needs to make several financial decisions that will ensure that the needs of its members are met to the greatest possible degree. Therefore, the goal of people creating a common household should be to achieve such economic efficiency that will enable the use of resources in the most effective and least wasteful way (Szudy, 2013).

As shown by previous research, households do not always manage the purchased food in an effective manner, as evidenced by the scale of wasted food. As results from the PROM study on food waste, an average of 3.9 kg of food (including edible and inedible parts) was thrown away in a household per week. On this basis, it has been estimated that in Poland approximately 2.9 million tons / year of food is wasted annually in this segment of the food chain (Łaba et al., 2020).

The identification of factors influencing the level of food waste in households is the key element (Aschemann Witzel, Hooge, Amani, BechLarsen and Oostindjer, 2015). It will enable the development and implementation of effective educational programs addressed to consumers. Thanks to them, it will be possible to reduce this adverse phenomenon (van Herpen and van der Lans, 2019).

According to many researchers (Jörissen, Priefer and Bräutigam, 2015; Koivupuro et al., 2012; Parizeau, von Massow and Martin, 2015), the amount of wasted food is correlated with demographic factors, especially the size of a household and the age of its members. As indicated by the results of the study conducted by Bilska, Tomaszewska, and Kołożyn-Krajewska (2020a), factors such as age, gender, place of residence, education have an impact on consumer behavior in the field of food management at home.

The aim of the study was to segment Polish households taking into account factors such as size (the number of adults and children), a subjective assessment of the financial situation and the declared percentage of food expenditure in terms of wasting prepared meals and meal components.

Material and methods

Collecting data

The study was conducted in February and March 2019 on a group of 1,115 adult respondents. The sample was selected randomly using the Statistics Poland database. The sample was representative of the general population for Poles aged over 18 in terms of sex, age, and the place of residence. The study was done in each of the sixteen voivodeships in Poland. After drawing the starting addresses, the so-called address route method was used in selecting the sample. The study was conducted using the CAPI (Computer Assisted Personal Interview) technique.

The segmentation of the respondents was carried out considering the following aspects: the number of adults in the household (over 18 years of age), the number of

children, a self-assessment of the financial situation of the household and the percentage of expenditure on food. Table 1 presents the characteristics of the respondents participating in the survey, considering the structure of households. Among the households surveyed, the largest number was observed in households with two adults in the family. Most respondents declared that there were no minors in their households. Among families with children (under 18), the survey was dominated by those with one child.

Table 1

Characteristics of respondents participating in the survey, considering the structure of households (n = 1115)

Characteristic	Characteristic	%
Sex	Woman	51.1
	Man	48.9
Age	18-34 years	28.2
	35-44 years	18.6
	45-59 years	27.3
	60 years and more	25.9
Place of residence	Village	38.2
	City up to 50.000	24.8
	City from 50.000 to 100.000	7.4
	City from 100.000 to 200.000	9.1
	City from 200 to 500.000	9.0
	City over 500.000	11.6
Number of people aged more than 18	1	17.2
	2	61.2
	3 or more	21.6
Number of children	0	72.7
	1	17.3
	2 or more	10.0
Subjective assessment of the financial situation	Good	41.6
	Average	57.6
	Refusal to answer	0.8
Percentage of food expenditure	Large (100-61%)	12.3
	Average (60-40%)	50.2
	Small (39-0%)	27.7
	Hard to say	9.8

Source: own study.

Before the research, a pilot study was conducted involving 30 people. All doubts and problems reported by the respondents were discussed and included in the questionnaire. The interview with the use of the revised questionnaire was conducted by trained interviewers.

Interview questionnaire

The developed questionnaire consists of two parts. The first part contains six questions related to: the frequency of preparing meals at home (Q1), the way of serving meals (Q2), the frequency of throwing away meals or ready-made products (Q3), the way of dealing with uneaten meals and stale bread (Q4, P5) and the frequency of using unused components of dishes to prepare other dishes (Q6). Responses to the questions about the frequency of activities were based on a 5-point scale with boundary definitions "always" – "never" (Q1, Q2, Q4, Q6) and a 4-point scale with boundary definitions "often" – "never" (Q3). What is more, in the case of question Q3, it was possible to respond choosing the "hard to say" and "not applicable" answer. In the case of question Q5, a selection of responses was possible.

The second part of the questionnaire was a record considering the following aspects: gender, age, the place of residence, the number of adults and children in the household, a subjective assessment of the financial situation, the percentage of food expenses.

Statistical analysis

The taxonomic analysis was performed using the Statistica 12.1 package (StatSoft, Krakow, Poland). The purpose of the analysis was the segmentation of households considering features such as size (the number of adults and children), subjective assessment of the financial situation and the declared percentage of food expenditure in terms of dealing with ready meals or products (e.g., bread, wilted fruit and vegetables). For this purpose, a multivariate cluster analysis method was used. Ward's hierarchical method was used to create clusters, using Euclidean distances. Homogeneous clusters of respondents were determined based on the average level of the arithmetic mean value and the fraction index values. The clusters were determined based on the binding distance to the binding steps. Five clusters were determined.

The cluster analysis was supplemented with examining the significance of differences between the average level of each element (constituting the multidimensional criterion of cluster formation) in selected clusters. The null hypothesis of equality of the mean value/fraction index (calculated for each cluster) was verified with the Fisher-Snedecor test, and the post-hoc analysis was performed with the NIR test. This enabled the identification of homogeneous groups of arithmetic means. This verification was performed at the significance level $\alpha = 0.05$.

Results

The practices of Polish consumers with respect to wasting meals and selected ready-made products

From the conducted research, it was found that more than half of the respondents prepare meals at home systematically (Table 2). It was also indicated that in a smaller part of Polish households (approx. 45%) meals are "always" or "usually" served collectively, e.g., on platters, in vases, i.e., in a way that allows for the selection of the portion size.

The questionnaire asked about the frequency of throwing away prepared food components and finished products suitable for consumption (Q3). It was noticed that in the case of all the above-mentioned groups of dishes/products, more than half of the respondents indicated that with different frequencies (often/sometimes/rarely), but still they are thrown away at homes. It should be emphasized that in all the analyzed cases the most frequent answer for this question was "sometimes" and "rarely". The majority of the respondents admitted throwing away any partially used and spoiled products (73.2%), expired products (70.5%), and wilted fruit and vegetables (70.3%). Among the components of ready meals, the majority of the respondents declared throwing away cooked starch additives, such as potatoes, rice, pasta (64.1% of responses). Slightly fewer people (59.3% of responses) often/sometimes/rarely threw away uneaten cooked vegetables. It was found that the smallest percentage of respondents admitted to throwing away uneaten meat from soup (50% of responses).

Responses for question Q3 concerning the frequency of throwing away, among others, uneaten meal components were confirmed in the section on the frequency of their use in the preparation of other dishes (Q6). It is the meat from soup, e.g., broth, that turns out to be a component of dishes most often used in the preparation of other dishes (approx. 1/3 of the responses "always" and "usually"). To a slightly lesser extent, the respondents declared using cooked potatoes, rice, and pasta (Q6:a), as well as cooked vegetables (Q6:c) in the preparation of other dishes. It has been noticed that wilted fruit and vegetables (Q6:d) are reluctantly used in the preparation of dishes. Only 13.6% of the respondents indicate that they "always" or "usually" use this type of products.

Table 2

Respondents' food handling in terms of food waste

No.	Question	Responses	%
Q1	**How often do you prepare meals at home?**	a) always / usually	53.3
		b) sometimes / rarely / never	46.7
Q2	**How often do you serve meals in a way that allows for the selection of the portion size (e.g., on platters, in vases)?**		
Q2:a	Breakfast	a) always / usually	44.5
		b) sometimes / rarely / never	55.5
Q2:b	Dinner	a) always / usually	46.0
		b) sometimes / rarely / never	54.0
Q2:c	Supper	a) always / usually	44.0
		b) sometimes / rarely / never	56.0
Q3	**How often do you throw away the following meal components / ready-made products?**		
Q3:a	uneaten sandwiches prepared for work	a) often	1.9
		b) sometimes / rarely	50.2
		c) never	35.4
		d) hard to say	2.7
		e) not applicable	9.8
Q3:b	uneaten cooked potatoes, rice, pasta	a) often	2.9
		b) sometimes / rarely	61.2
		c) never	29.0
		d) hard to say	3.1
		e) not applicable	3.8
Q3:c	uneaten cooked vegetables	a) often	3.0
		b) sometimes / rarely	56.3
		c) never	34.5
		d) hard to say	2.6
		e) not applicable	3.6
Q3:d	uneaten meat from soup, such as broth	a) often	1.9
		b) sometimes / rarely	48.1
		c) never	42.3
		d) hard to say	3.1
		e) not applicable	4.6
Q3:e	wilted vegetables and fruit	a) often	3.6
		b) sometimes / rarely	66.7
		c) never	21.9
		d) hard to say	3.6
		e) not applicable	4.2
Q3:f	expired products	a) often	4.8
		b) sometimes / rarely	65.7
		c) never	21.2
		d) hard to say	3.4
		e) not applicable	4.9

cont. Table 2

Q3:g	opened products with signs of deterioration	a) often	7.0
		b) sometimes / rarely	66.2
		c) never	18.1
		d) hard to say	2.9
		e) not applicable	5.9
Q4	**How and how often do you handle uneaten meals?**		
Q4:a	cooling to room temperature and then refrigerating	a) always / usually	49.6
		b) sometimes / rarely / never	50.4
Q4:b	throwing into a waste container	a) always / usually	15.8
		b) sometimes / rarely / never	84.2
Q4:c	freezing	a) always / usually	15.5
		b) sometimes / rarely / never	84.5
Q4:d	giving out to family, friends	a) always / usually	8.0
		b) sometimes / rarely / never	92.0
Q4:e	use for feeding animals	a) always / usually	23.8
		b) sometimes / rarely / never	76.2
Q4:f	use in the preparation of other dishes	a) always / usually	25.3
		b) sometimes / rarely / never	74.4
Q4:g	composting	a) always / usually	8.1
		b) sometimes / rarely / never	91.1
Q5	**How do you handle stale bread?**	a) I prepare the so-called breadcrumbs	35.0
		b) I use it for other dishes	14.0
		c) I throw it away with other waste	15.8
		d) I put it in a special place for dry bread in a garbage can	14.9
		e) I feed animals	31.5
		f) I give it away to people who have pets	15.4
		g) I do not let bread become stale	14.5
Q6	**How often do you use the following products to prepare other dishes?**		
Q6:a	cooked potatoes, rice, pasta	a) always / usually	28.8
		b) sometimes / rarely / never	71.2
Q6:b	meat from soup, e.g. broth	a) always / usually	31.7
		b) sometimes / rarely / never	68.3
Q6:c	cooked vegetables	a) always / usually	27.7
		b) sometimes / rarely / never	72.3
Q6:d	wilted vegetables and fruit	a) always / usually	13.6
		b) sometimes / rarely / never	86.4

Source: own study.

It has been found that excess of prepared and uneaten meals is most often cooled down to room temperature and then put into the refrigerator. Almost half of the people participating in the study indicated that they "always" or "usually" do it (Table 2). In 1/4 of Polish households, meals of this type are usually used for preparing other dishes or feeding animals. On the other hand, the fewest respondents declared that they gave away uneaten meals to their family and friends or composted them (about 8% of responses are "always" and "usually" in both cases).

The respondents were also asked about how they handle stale bread (P5). Most of them (over 1/3) declared to prepare the so-called breadcrumbs. The second most frequently indicated method of dealing with stale bread turned out to be feeding animals (almost 1/3 of responses). The fewest respondents declared using stale bread for other dishes and putting it into a garbage bin designed for dry bread (approx. 14% of responses in both cases). Only 1/7 of the respondents indicated that they handled bread in a way that it did not become stale.

Characteristics of the identified clusters

Based on the responses and the conducted analysis, five clusters were identified. The characteristics of the clusters are presented in Table 3.

Table 3

Characteristics of selected clusters (N = 1087)

Cluster	Total of N	Share of a cluster in the studied population (%)	Share in the cluster (%)			
			Number of persons over 18 years of age (a)	Number of children (b)	Subjective assessment of the financial situation (c)	Percentage of food expenses (d)
A	754	69.37	A1: 22.68 A2: 69.76 A3: 7.56	D0: 75.99 D1: 14.85 D2: 9.15	Good FS: 45.36 Average FS: 53.05 RR: 1.59	S: 20.03 A: 72.81 L: 5.57 RR: 1.59
B	219	20.15	A1: 0.00 A2: 35.16 A3: 64.84	D0: 84.02 D1: 12.33 D2: 3.65	Good FS: 16.89 Average FS: 83.11 RR: 0.00	S: 56.16 A: 32.42 L: 3.65 RR: 7.76
C	43	3.95	A1: 23.26 A2: 18.60 A3: 58.14	D0: 81.40 D1: 0.00 D2: 18.60	Good FS: 67.44 Average FS: 32.56 OA: 0	S: 0.00 A: 0.00 L: 100 RR: 0
D	45	4.14	A1: 20.00 A2: 80.00 A3: 0.00	D0: 68.89 D1: 17.78 D2: 13.33	Good FS: 48.89 Average FS: 51.11 RR: 00.00	S: 13.33 A: 0.00 L: 86.67 RR: 0.00
E	26	2.39	A1: 0.00 A2: 50.00 A3: 50.00	D0: 0.00 D1: 69.23 D2: 30.77	Good MS: 38.46 Average FS: 30.77 RR: 30.77	S: 50.00 A: 0.00 L: 19.23 RR: 30.77

A1:1 person; A2:2 persons; A3:3 persons or more;
D0: 0 children; D1: 1 child; D2: 2 children or more;
Good MS: good financial situation; Average FS: average financial situation; RR: refusal to respond;
S: small (0-39%); A: average (40-60%); L: large (61-100%); RR: refusal to respond.

Source: own study.

Cluster A turned out to be the most numerous cluster (69.37%), dominated by respondents living in two-person households (over 18 years of age), without children, declaring an average financial situation and an average percentage of food expenditure (within 40-60%). The second largest group was cluster B (20.15%). This cluster was dominated by people from households with three or more adults, without children, also declaring an average financial situation, but a small percentage of expenditure on food (up to 39%). In cluster C (3.95%), the predominant share was like that from households with three or more adults, without children, but indicating a good financial situation and a significant percentage of food expenses (61-100%). Cluster D (4.14%) consisted mainly of respondents from households inhabited by two adults, without children, with a declared average or good financial situation and a large percentage of food expenses. The last cluster E turned out to be the least numerous (2.39%). It consisted equally of households with two adults and three and more. The presence of children (mainly one child) turned out to be a distinguishing feature from clusters A-D. Respondents from these households declared a rather good financial situation and a small percentage of expenditure on food (Table 3).

Elements of handling ready-made food components and ready-made products characteristic for the indicated clusters

Based on the carried out cluster analysis, it was found that the five clusters (A, B, C, D and E) did not differ significantly in responses on such issues such as: collective serving of meals (Q2), throwing away: uneaten sandwiches (Q3:a), cooked vegetables (Q3:c), meat from soup (Q3:d), expired products (Q3:f) or opened products with signs of deterioration (Q3:g) (Table 4). The respondents assigned to separate clusters declared throwing away uneaten meals into a waste container with a similar frequency (Q4: b).

However, it was found that the identified clusters differ significantly in the remaining analyzed situations (Table 4).

Respondents classified in the largest **cluster A**, i.e., mainly from childless households, consisting mainly of two adults, declaring an average or good financial situation and a percentage of food expenses between 40 and 60%, declared that they "usually" prepared meals at home (similarly like clusters C and D). At the same time, the respondents included in this cluster declared that they "sometimes" threw away cooked starch additives such as potatoes, rice, pasta, and wilted fruit and vegetables. It was noticed that respondents in cluster A gave uneaten meals to animals (Q4:e), including stale bread (Q5:e), much less frequently compared to the other groups.

Cluster B was mainly composed of respondents living in childless households of at least three (adults) declaring low expenditure on food (up to 39%). People in this cluster ($p < 0.05$) declared preparing meals at home the least frequently ("sometimes") (Table 4). People in this cluster threw away cooked potatoes, rice, and pasta with a similar frequency ("sometimes") as respondents in cluster A, C,

and D, and wilted fruit and vegetables as respondents in other clusters. What distinguished consumers from cluster B, as compared to the rest, was the fact that they significantly more often declared using meat from soup for other dishes, e.g., broth (Q6:b).

Respondents in cluster C are again people from households consisting of at least three adult members, rather childless, but declaring large expenses on food (61-100%). People qualified in this cluster "usually" prepare meals at home (like in clusters A and D). It was noticed that respondents from cluster C, more often than in the remaining groups ($p < 0.05$), gave uneaten meals away to family/friends (Q4:d) and used them to feed animals (Q4:e). They also used stale bread to a greater extent, as compared to other clusters, for feeding animals (Q5:e). Respondents from cluster C significantly more often ($p < 0.05$) declared using wilted fruit and vegetables (Q6: d) to prepare other dishes.

Cluster D, including mainly households consisting of two adults, rather without minors, declaring large expenditure on food (61-100%) also "usually" prepare meals at home (like in clusters A and C). People in this cluster indicated that uneaten meals were cooled down to room temperature, and then placed in a refrigerator (Q4:a) and used to prepare other dishes (Q:4f) significantly less frequently ($p < 0.05$), as compared to the other groups. However, they indicated more often ($p < 0.05$) that stale bread in their households was thrown away with other waste (Q5:c). It also turned out that respondents from cluster D used meat from soup, e.g., broth, to prepare other dishes (Q6:b) much less frequently, as compared to the remaining groups. What is more, cooked potatoes, rice or pasta are used in their households to prepare other dishes to a lesser extent (Q6:a).

Cluster E, the last one, turned out to be the only one with children in the households – mainly one. People from these households declared low expenditure on food (up to 39%). Respondents in this segment indicated preparing meals at home (Q2) significantly more often compared to other groups. At the same time, the lowest rate in the question regarding the frequency of throwing away potatoes, rice, and pasta (Q3:b), as well as wilted fruit and vegetables (Q3:e) indicates that respondents from cluster E most often indicated throwing away the above-mentioned groups of products. It was also found that much more often ($p < 0.05$) they declared freezing uneaten meals (Q4:c) and using stale bread to prepare other dishes (Q5:b), as compared to the other clusters.

Table 4

The average level of the frequency index (Q1, Q2, Q3, Q4, Q6) or the arithmetic mean (Q5) for the selected clusters and the results of the analysis of variance and the NIR test

Question [B)]		Cluster [A)]					p-value
		A	B	C	D	E	
Q1		2.31[b]	2.9[3]c	2.21[b]	2.22[b]	1.73[a]	0.000
Q2:a		2.76	2.88	2.63	2.56	2.33	0.106
Q2:b		2.72	2.84	2.46	2.46	2.53	0.129
Q2:c		2.78	2.88	2.73	2.40	2.49	0.087
Q3:a		3.28	3.39	3.06	3.21	3.16	0.079
Q3:b		3.12[b]	3.16[b]	2.98[ab]	3.17[b]	2.76[a]	0.010
Q3:c		3.16	3.24	3.03	3.22	3.11	0.599
Q3:d		3.35	3.42	3.23	3.19	3.33	0.504
Q3:e		3.02[b]	2.99[ab]	2.80[a]	3.12[b]	2.60[a]	0.004
Q3:f		2.97	2.92	2.88	3.02	2.97	0.822
Q3:g		2.81	2.94	2.66	3.05	2.77	0.064
Q4:a		2.63[a]	2.52[a]	2.47[a]	3.09[b]	2.24[a]	0.005
Q4:b		3.65	3.84	3.48	3.42	3.36	0.089
Q4:c		3.58[b]	3.32[b]	3.40[b]	3.68[b]	2.83[a]	0.000
Q4:d		4.08[c]	3.75[b]	3.42[a]	3.93[bc]	3.88[bc]	0.000
Q4:e		3.61[c]	3.24[bc]	2.87[a]	3.10[b]	3.11[b]	0.001
Q4:f		3.10[b]	2.86[a]	3.03[ab]	3.50[c]	2.84[a]	0.001
Q4:g		4.41c	4.08[b]	3.68[a]	3.85[ab]	4.66[b]	0.000
Q5	a. I prepare breadcrumbs	0.35	0.36	0.39	0.28	0.47	0.424
	b. I use it for other dishes	0.13[b]	0.13[b]	0.17[b]	0.17[b]	0.06[a]	0.047
	c. I throw it away	0.13[a]	0.12[a]	0.11[a]	0.29[b]	0.14[a]	0.026
	d. I put it into garbage	0.17[b]	0.11[ab]	0.04[a]	0.14[b]	0.19[b]	0.030
	e. I feed animals	0.29[a]	0.37[b]	0.48[c]	0.39[b]	0.38[b]	0.047
	f. I give it to others	0.17	0.17	0.16	0.14	0.19	0.974
	g. I do not let bread become stale	0.16	0.14	0.09	0.06	0.05	0.063
Q6:a		3.01a[b]	2.67[a]	2.81[a]	3.18[b]	3.02[ab]	0.018
Q6:b		3.06[b]	2.64[a]	2.92[b]	3.44[c]	2.99[b]	0.001
Q6:c		3.25[b]	2.77[a]	2.89[a]	3.24[b]	2.99[ab]	0.000
Q6:d		3.82[b]	3.76[b]	3.28[a]	3.95[b]	3.82[b]	0.019

The same letter with the arithmetic mean value or the frequency index means that there are no significant differences between clusters

Scale direction: questions Q1, Q2, Q4, Q6 from 1 – "always" to 5 – "never", question Q3 from 1 – "often" to 5 – "hard to say".

Source: own study.

Discussion

The study identifies five consumer clusters differing in aspects such as, i.e., the number of adults, the number of children, a subjective assessment of the financial situation, and the percentage of expenditure on food. Despite the observed differences in patterns in three clusters, several similarities were also found. All clusters with a similar frequency threw away food products due to spoilage and passed expiration date. Such behavior of consumers contributing to food waste is indicated by many researchers (Jörissen et al., 2015; Koivupuro et al., 2012, Silvennoinen, Katajajuuri, Hartikainen, Jalkanen and Reinikainen, 2014). A significant percentage of respondents participating in the study declared throwing away cooked vegetables and meat. Proper meal planning is a key factor in organizing shopping properly and reducing leftovers after cooking a meal (Romani, Grappib, Bagozzi & Barone, 2018). According to the WRAP report (2007), more food is thrown away after preparation in relation to the purchased and unused products. According to Stancu, Haugaard, and Lähteenmäki (2016), a proper use of leftovers can contribute to reducing the level of food waste. Reusing leftovers is possible only when a meal is served in a manner that allows for the selection of the portion size (e.g., on platters, in vases) and the leftovers are properly and safely stored in a refrigerator. Most of the respondents indicated that they serve meals quite often in a way that enables the selection of the portion size, while throwing away unconsumed components of meals. This may indicate that household members put too much on their plate or are reluctant to reuse leftovers. Food preparation skills can be an important issue. According to Fami, Aramyan, Sijtsema, and Alambaigi (2019), households with greater food consumption management waste less food.

Despite the observed similarities between the clusters, some significant differences were also found. Cluster E, dominated by households with children, indicated the preparation of meals at home more often than in the remaining groups. On the other hand, it was found that people from this cluster rarely used wilted fruit and vegetables, as well as cooked potatoes, rice, and pasta. Available studies indicate that the number of children may have a disproportionate effect on the level of food waste due to the unpredictable behavior and dietary preferences of children and the parents' willingness to serve fresh and top-quality products (Ganglbauer, Fitzpatrick, and Comber, 2013; Hanssen, Syversen, and Stø, 2016; Cappellini and Parsons, 2012). It should be noted that this cluster declared low expenditure on food (up to 39%).

On the other hand, cluster B, consisting of households with at least three adults and without children, declared preparing meals at home the least frequently. Both clusters declared low expenditure on food.

Cluster D is surprising, as it declared large expenses on food (61-100%), while at the same time much less frequently, as compared to other groups, used meat from soup, e.g., broth, cooked potatoes, rice, or pasta for other dishes. A similar observation was made by Schanes et al. (2018) who found that households spending more

on food per one person tend to produce more food waste. On the one hand, this may mean that food is important to people in this cluster, and on the other hand, they buy too much and do not always manage to get the most out of it.

Bilska et al. (2020b) observed the lowest frequency of throwing away 13 product groups in the cluster that declared a good financial situation. In the same study, cluster C (consisting of households with at least three adults, rather without children), declaring the best financial situation, used wilted vegetables and fruit to prepare other dishes significantly more often. Another observation was made by Ishangulyyev, Kim, and Lee (2019). They found that higher-income households tend to waste more food because food is relatively cheaper than other goods. The observation from the study may indicate a greater ecological awareness of people from cluster C.

Conclusions

Five clusters were identified, differing in size, composition, the assessment of the financial situation and the level of food expenditure.

The indicated clusters did not differ significantly in the responses to the following issues: collective serving of meals, throwing away of uneaten sandwiches, cooked vegetables, meat from soup, expired products or opened products with signs of deterioration. Respondents assigned to given clusters declared throwing uneaten meals into a waste container with a similar frequency.

It has been found that households with children, as compared to those without children, are reluctant to use lower-quality fruit and vegetables, as well as food residues, such as potatoes. This behavior may be due to the parents' intention to provide their children with fresh products and to meet their children's frequently changing food preferences.

Paradoxically, in households with high expenditure on food, leftovers such as rice, and pasta are also used to a small extent. This may mean that people from such households have a problem with managing both financial resources and the purchased food.

The frequency of preparing meals at home is also related to the presence of children in the household. Households with children are more likely to prepare meals at home, which is probably related to the desire to provide optimal nutrition to the youngest family members.

To sum up, proper food handling in households is one of the key areas in food management in the context of reducing waste. It is therefore necessary to take measures to reduce food waste. To develop and implement education programs for consumers, it is essential to understand factors behind food waste in households

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SEGMENTACJA GOSPODARSTW DOMOWYCH Z UWZGLĘDNIENIEM ICH STRUKTURY W ASPEKCIE MARNOWANIA POSIŁKÓW

Abstrakt

Gospodarstwa domowe nie zawsze zarządzają zakupioną żywnością w sposób efektywny, o czym świadczy skala marnowanej żywności. Z badania marnotrawstwa żywności przeprowadzonego w ramach projektu PROM wynika, że tygodniowo w gospodarstwie domowym wyrzucano średnio 3,9 kg żywności (w tym części jadalne i niejadalne). Kluczowym aspektem jest zrozumienie czynników determinujących marnotrawstwo żywności w gospodarstwie domowym, które pozwoli na opracowanie i wdrożenie programów edukacyjnych kierowanych do konsumentów. Celem badania było przeprowadzenie segmentacji w celu zidentyfikowania grup konsumentów charakteryzujących się podobnym postępowaniem z żywnością, ze szczególnym uwzględnieniem marnotrawstwa posiłków. Segmentacja przeprowadzona na reprezentatywnej grupie Polaków powyżej 18 r.ż. pozwoliła na zidentyfikowanie 5 klastrów. Zdiagnozowane skupienia konsumentów różnią się cechami, takimi jak: liczba osób dorosłych, liczba dzieci, subiektywna ocena sytuacji materialnej, odsetek wydatków na żywność. Stwierdzono, że najczęściej posiłki w domu przygotowywał segment E składający się z gospodarstw domowych z dziećmi. Jednocześnie najczęściej osoby z tego skupienia wyrzucały zwiędnięte owoce i warzywa oraz ziemniaki, ryż i makaron. Segment D, który deklarował duże wydatki na żywność (61-100%), jednocześnie zdecydowanie rzadziej, w porównaniu z pozostałymi grupami, wykorzystywał do przygotowania innych potraw mięso z zupy, ugotowane ziemniaki, ryż, makaron. Segment C, który deklarował najlepszą sytuację finansową, istotnie częściej wykorzystywał zwiędnięte warzywa i owoce do przygotowywania innych potraw. Mający największy udział w badanej próbie segment A (prawie 70%) często tworzył tzw. grupy jednorodne z pozostałymi wyodrębnionymi skupieniami. Jednak można zauważyć, że częściej wskazywał wyrzucanie ugotowanych dodatków skrobiowych oraz zwiędniętych owoców i warzyw. Podsumowując, należy stwierdzić, że konieczne jest podjęcie działań ograniczających marnotrawstwo żywności w ogniwie gospodarstw domowych.

Słowa kluczowe: marnotrawstwo żywności, analiza skupień, gospodarstwa domowe, segmentacja, praktyki żywieniowe.

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