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POLISH CONSUMERS' PREFERENCES IN VEGETABLE CONSUMPTION

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Purpose: This study aimed to analyze changes in the consumption of vegetables in Poland and assess consumer preferences for their consumption.
Methodology: In the article, the results of macroeconomic analyses of changes in the consumption of fresh and processed vegetables in Poland in 2015-2022, by category, developed based on CSO data, are presented. The main part of the paper is based on the analysis of data from surveys conducted among 255 respondents from all over Poland. Statistical analyses used the Mann-Whitney U test and the Kruskal-Wallis ANOVA test.
Findings: From 2015 to 2022, the consumption of vegetables and processed foods in general showed a slight decreasing trend. The highest growth rate was recorded for processed and frozen vegetables and the group of other vegetables, indicating that consumers are increasingly opting for processed or pre-processed foods, which reduce meal preparation time. In turn, the positive growth rate in the consumption of fresh vegetables from the group of other vegetables indicates that consumers are seeking more and more new flavors, expanding the range of vegetables they consume.
The survey showed that despite the increase in the price of vegetables, caused by high inflation in Poland, more than half of the respondents did not reduce their consumption of vegetables, which proves that the amount of vegetables consumed is due to certain eating habits of consumers and that the price increase contributed to their search for substitute products that are more favorable in terms of price. Among the most consumed vegetables were tomatoes, as well as cucumbers and carrots, while the key factor in deciding whether to buy vegetables was their freshness, and quality, and only in third place was price. Noteworthy is the fact that just over half of the respondents consume vegetables daily, which is what the nutritional standards indicate. This proves that there is still a lot of work to be done in terms of nutrition education for the public, especially since the average consumption of vegetables in Poland is far from the European average.

Originality/value: The significance of the research conducted lies in a better understanding of consumers' vegetable consumption behaviour, their response to changing market conditions (e.g., price increases or inflation) and the impact of eating habits on consumer choices. This is important information for both the agricultural sector and vegetable trading companies, which can better adjust sales and marketing strategies based on this information. The research can also help formulate health and education policies to promote healthy eating habits in society.
Keywords: vegetables, consumer preferences, vegetable consumption.
Category of work: research work.

1. Introduction

Vegetables and fruits are fundamental components of a healthy diet. In 2016, the Food and Nutrition Institute released the latest version of the nutrition and physical activity pyramid, which emphasizes that fruits and vegetables form the foundation of proper nutrition. Notably, in the previous version, these foods were positioned on the second tier, below grain products. Fruits and vegetables are rich sources of essential nutrients and health-promoting components, including antioxidants. Therefore, it is crucial to incorporate an adequate supply of these foods into our daily diets. Key dietary antioxidants include vitamin C, vitamin E, carotenoids, exogenous coenzyme Q10, and polyphenolic compounds (Kalędkiewicz, Lange, 2013). Additionally, fruits and vegetables are low in fat and calories, with vegetables also being low in sugars (Wawrzyniak et al., 2011; Gronowska-Senger, 2015). Regular consumption of fruits and vegetables can significantly reduce the risk of stroke, heart disease, type II diabetes, and certain types of cancer. They also enhance the immune system, improve digestive health, and lower the likelihood of being overweight or obese (Ostrowska et al., 2003; Kazimierczak, 2004; Devirigliis et al., 2024). Despite the vital role of fruits and vegetables in our diet, their consumption in the Polish market remains insufficient.

Recommendations from the WHO and various EU national agencies suggest that fruits and vegetables should form the basis of our diet, with a recommended daily intake of around 400 grams. However, research and Eurostat data indicate that actual consumption levels are significantly lower than these recommendations. The amount of fruits and vegetables people consume varies widely and is influenced by factors such as gender, income level, education, and place of residence. Generally, women, individuals with higher income and education levels, and residents of southern European countries tend to consume more fruits and vegetables (Bieniek-Majka, 2022). Alarmingly, low consumption rates are particularly evident in low- and middle-income countries, where over 80% of individuals over the age of 15 consume less than the recommended amount of fruits and vegetables (Frank et al., 2019).

The demand for vegetables is increasing as consumers are becoming more aware of their importance in a healthy diet. People are focusing not only on the basic functions of food but also on the nutritional benefits of vegetables, which are rich in vitamins, minerals, and fiber (Przybysz et al., 2016; Olewnicki et al., 2016). The consumption of both vegetables and fruits is fundamental to maintaining a healthy lifestyle (Mikulec et al., 2023). Additionally, informed consumers are seeking foods that meet functional criteria (Grębowiec, 2018), which has led to the growth of vegetable and fruit production and their processing into new forms. In Poland, the past decade has seen a shift in the structure of vegetable consumption. The share of spending on potatoes and unprocessed vegetables has decreased, while expenditures on processed vegetables in various forms have increased (Murawska, 2016). Despite a long-term upward trend in the consumption of fruits and vegetables (Goryńska-Goldmann, 2024), Engel's law indicates that the overall share of food spending in Poland, including for vegetables, has been declining. However, the proportion of vegetable spending has remained fairly constant at around 10% of total food expenditures (Murawska, 2016).

The progressive development of vegetable processing techniques and modern packaging has made it possible to offer consumers vegetables with a longer shelf life, while preserving their sensory qualities (Domagała et al., 2021). Studies indicate that traditional marketplaces are no longer the primary places for purchasing vegetables, as the share of big-box stores has significantly increased (Grzybek, Szopinski, 2016; Lubańska, 2009). These changes have posed a considerable challenge for vegetable distribution, as products must now be processed more extensively, with larger batch sizes to meet the increased demands of retail supply logistics. Participating in large-scale retail supply often requires additional investments in pre-preparation, packaging systems, and production certification (Lubańska, 2009).

Poland's entry into the European Union, along with a significant concentration and improvement in vegetable production, led to an expansion in exports (Jąder, 2012; Pawlak, 2014; Bugała, 2016; Jąder, 2017; Kapusta, 2017). This situation required not only an increase in the concentration of vegetable production and processing but also an enhancement in production quality and the implementation of certification systems mandated by international buyers (Kurek, 2007; Chernyshevich, 2011). In this context, producer groups played a crucial role, as their involvement was essential for achieving short-term changes (Chlebicka, 2020; Olewnicki et al., 2021). Consequently, vegetables became a significant component of Polish agri-food exports (Zelazowska, 2012; Pawlak, 2014).

Additionally, differences in pricing between Poland and other EU countries have also contributed to this export growth (Sobczak, Jablonska, 2015). It is important to note that a positive balance in foreign trade was mainly achieved through exports of processed vegetables, while trade in fresh vegetables remained negative (Filipiak, 2010). The increased demand for processed products for export has led to a rise in the share of processing within Polish agribusiness from 40% to 56% between 2000 and 2022 (Wicka, Wicki, 2024). Thus, foreign trade has become one of the key factors driving the development and

transformation of Polish agriculture since 2000, in addition to domestic demand (Runowski et al., 2023). However, there is a consensus that new markets must continually be sought due to escalating competition (Bulkowska, 2024). Significant fluctuations in vegetable market prices remain a negative factor in production development planning (Sobczak, Jablonska, 2015), a challenge that persists despite improvements in market organization.

The study aimed to analyze changes in vegetable consumption in Poland and to assess consumer preferences based on survey results.

The information presented in the study can become useful to various stakeholder groups. First of all, producers and farmers will be able to adjust their production strategies to changing consumer preferences and market conditions, such as price increases and inflation. Vegetable traders, both retail and wholesale, will use the data to optimize their offers and select appropriate sales channels. Companies marketing and distributing food products will be able to better align their campaigns with current consumption trends. In addition, public authorities and public health organizations can use the results to formulate health and education policies that promote appropriate eating habits.

2. Material and methods

The study presents as a background for the study of consumer preferences the results of macroeconomic analyses of changes in the consumption of vegetables, both fresh and processed, by their respective categories, in Poland over the years 2015-2022. The primary source of information for macroeconomic analyses was data from the survey of household budgets, conducted by the Central Statistical Office. The year 2015 was taken as 100%, from which the basic parameters statistical parameters giving a summary description of the analyzed phenomenon were calculated, including fixed-base indices, with the help of which changes in the size of absolute data in the last analyzed year about the base year were analyzed. By calculating chain indices (with a variable base), the average annual rate of changes under study was determined, the measure of which in the period under study (t_0, t_1) was the difference between the average chain index of the period and unity (Gorczynski, 2004). The coefficients of variation, which are the quotient of the standard deviation and the arithmetic mean of the values studied, were also calculated.

The main part of the paper is the analysis of primary data from surveys conducted using the CAWI method, on a group of 255 respondents, nationwide, in 2023. Women accounted for the largest share of the surveyed population, i.e. 60.0% of the total, taking part in the research. Men, on the other hand, accounted for 40.0%. The survey also established four age groups of respondents, i.e. 18-30 years old, 31-45 years old, 46-60 years old and over 60 years old. The largest group, 116 people (45.5%), were respondents aged 18-30. The percentage of respondents aged 31-45 was 30.2%, while those aged 46-60 and over 60 were 15.7% and 8.6%, respectively. Another factor characterizing the survey population was the place of residence. The largest group of study participants were residents of cities with a population of less than 50,000 (30.2%). The second smaller group among the survey participants were residents of cities with more than 250,000 residents accounting for 27.5%. The share of rural residents was 26.7%, while the smallest group, only 5.9% of people lived in a city with a population of 52,000 to 99,900.

Taking into account the monthly disposable income per person in the household, the largest number, 44.7%, of respondents had incomes above PLN 3000. The second largest group, in terms of numbers, were respondents with incomes between 2001 and 3000 PLN. The least numerous group of respondents (6.3%) were those with per capita incomes of up to PLN 1000.

The next aspect characterizing the surveyed population was their socioeconomic situation. The largest group of respondents were those employed in a company or office (47.8%) and students (25.9%). No farmers took part in the survey. The smallest group, only 3.14%, were people not working anywhere.

Considering the number of people in the household, the largest group was two people in the household, with 32.2%. In contrast, the smallest groups were six and seven people in the household. They accounted for 2.0% and 0.4% of the total surveyed population, respectively.

Analyses were performed using Statgraphics plus 4.1. Due to the lack of normal distribution and unequal groups, the significance of differences was tested with non-parametric tests statistical Mann-Whitney U test for two grouping variables for gender and Kruskal-Wallis ANOVA test for questions where there were more than three grouping variables. A significance level of $\alpha = 0.05$ was used in the analyses.

When interpreting the survey results, it should be kept in mind that in surveys, various factors can limit the results and affect the quality of the data. This can include errors resulting from difficulties in recalling information or the phenomenon of social desirability, when survey respondents provide answers according to the public's expectations rather than their own beliefs or experiences, as in the case of answers regarding a healthy lifestyle, such as eating organic vegetables. When creating the survey questionnaire, the authors made every effort to ensure that the form of the survey was conducive to providing reliable answers, which is facilitated by, among other things, the anonymity of the survey or the use of questions with a time reference to the event, which could help respondents recall specific activities more accurately.

3. Analysis of vegetable consumption based on CSO data

The analysis carried out showed that the consumption of vegetables, mushrooms and preserves excluding potato preserves including mushroom preserves in households in 2022 was 54.4 kg/person, which was 6.2% lower than in 2015 (Table 1). It is noteworthy that in the case of fresh and refrigerated vegetables and mushrooms in 2022, consumption fell compared to the first year of the period under review. There was a clear decrease in the consumption of beets by 30.0% from 2.4 kg/person in 2015 to 1.7 kg/person in 2022. Also, there was a decrease in the consumption of cabbage by 20.0%, cauliflower vegetables by 11.8%, tomatoes by 11.9%, cucumbers by 17.6% and carrots by 14.9%. The smallest decrease was in onions by 4.4%. Noteworthy is the increase in consumption of frozen vegetables including mushrooms from 1.8 kg/person in 2015 to 2.0 kg per person in 2022 by 13.3%, as well as processed vegetables excluding processed potatoes, including processed mushrooms by 16.2%.

In general, it should be pointed out that the overall consumption of vegetables, mushrooms and preserves excluding potatoes showed a downward trend, with an average annual rate of decline of 0.9%, and the coefficient of variation was 2.8%. There was an average annual decrease in consumption of vegetables such as cabbage by 3.1%, cauliflower vegetables by 1.8%, tomatoes by 2.7%, cucumbers by 2.7%, carrots by 2.3%, beets by 5.0% and onions by 0.6%. The coefficient of variation was 9.6%, 4.8%, 4.0%, 8.3%, 8.4%, 15.0% and 2.6%, respectively. Frozen vegetables including mushrooms saw a 1.8% increase in the average annual rate of change, and processed vegetables excluding processed potatoes including processed mushrooms by 2.2%.

Table 1.
Vegetable consumption in households in Poland from 2015 to 2022

Specification	2015		2016		2017		2018		2019		2020		2021		2022		The average annual rate of change	Coefficient of variation
	kg/person	%	kg/person	%	kg/person	%	kg/person	%	kg/person	%	kg/person	%	kg/person	%	kg/person	%		
Vegetables, mushrooms and preserves*	58.0	100.0	59.0	101.9	58.2	100.4	56.4	97.3	55.2	95.2	56.8	97.9	55.9	96.5	54.4	93.8	-0.9	2.8
Fresh and refrigerated vegetables and mushrooms	47.9	100.0	48.6	101.5	47.6	99.5	45.8	95.7	44.0	92.0	44.9	93.7	44.2	92.2	42.8	89.5	-1.6	4.6
cabbage	5.4	100.0	5.3	97.8	5.0	93.3	4.7	86.7	4.3	80.0	4.4	82.2	4.3	80.0	4.3	80.0	-3.1	9.6
cauliflower	2.0	100.0	1.8	88.2	1.9	94.1	1.8	88.2	1.8	88.2	1.8	88.2	1.8	88.2	1.8	88.2	-1.8	4.8
tomatoes	10.1	100.0	10.0	98.8	9.6	95.2	9.7	96.4	9.5	94.0	9.6	95.2	9.2	91.7	8.9	88.1	-1.8	4.0
cucumbers	6.1	100.0	6.4	103.9	5.9	96.1	5.8	94.1	5.6	92.2	5.3	86.3	5.2	84.3	5.0	82.4	-2.7	8.3
carrot	5.6	100.0	5.9	104.3	6.0	106.4	5.3	93.6	4.9	87.2	5.2	91.5	5.0	89.4	4.8	85.1	-2.3	8.4
beets	2.4	100.0	2.5	105.0	2.4	100.0	2.2	90.0	1.9	80.0	1.9	80.0	1.8	75.0	1.7	70.0	-5.0	15.0
onion	5.4	100.0	5.4	100.0	5.4	100.0	5.2	95.6	5.0	93.3	5.3	97.8	5.3	97.8	5.2	95.6	-0.6	2.6
other vegetables and mushrooms	10.8	100.0	11.4	105.6	11.4	105.6	11.3	104.4	10.9	101.1	11.4	105.6	11.5	106.7	11.2	103.3	0.5	2.3
Frozen vegetables**	1.8	100.0	1.9	106.7	1.9	106.7	1.9	106.7	2.0	113.3	2.2	120.0	2.2	120.0	2.0	113.3	1.8	6.4
Vegetable preparations***	8.2	100.0	8.5	104.4	8.6	105.9	8.6	105.9	9.1	111.8	9.7	119.1	9.6	117.6	9.5	116.2	2.2	6.4
sauerkraut	2.0	100.0	2.0	100.0	1.9	94.1	1.9	94.1	1.9	94.1	1.9	94.1	1.8	88.2	1.7	82.4	-2.7	6.2
Vegetable and vegetable-fruit juices	1.7	100.0	2.2	128.6	1.9	114.3	1.9	114.3	1.9	114.3	1.9	114.3	1.8	107.1	1.7	100.0	0.0	8.3

* without potatoes,
** including mushrooms,
*** excluding processed potatoes, including processed mushrooms.

Source: own compilation according to IERiGŻ PIB study based on unpublished CSO data.

4. Survey results

Grocery shopping is one of the basic activities performed almost daily. It was therefore important to determine, the frequency of purchasing vegetables during such activities. The survey showed that the vast majority of respondents purchased conventionally grown vegetables very often and frequently. In the case of vegetables, very frequent and frequent purchases were indicated by 48.6 and 44.3% of respondents, respectively. Respondents, on the other hand, rarely bought vegetables labelled BIO, as indicated by 32.5% of respondents, respectively. It is worth noting that one-fifth of the survey participants did not purchase these products at all (Fig. 1). Also, a study conducted by Zmarlicki (2010) on a group of Skierniewice students proved that the willingness to purchase organically grown vegetables more than a decade ago was also negligible. The implication is that despite the passage of years, consumers' attitudes toward buying this type of food are still incidental. Most respondents indicated that they would be able to purchase BIO vegetables if their price was similar to conventionally grown products. Another issue of lack of interest in organic products indicated by the above author was often their unattractive appearance, which did not encourage consumers to purchase them.

The above proves that it would be worth investigating the relationship between the level of consumption of organic food and consumer awareness of healthy eating, including food safety, as well as the perception of this type of food, including its proper labeling. However, a literature review has shown that consumer awareness does not go hand in hand with an increase in the consumption of organic products. As Borychowski (2023) cites, spending on organic products in Poland was estimated at only 4 euros per year per citizen. Although public awareness of environmental issues and the negative consequences of conventional agriculture, which is mainly focused on maximizing profits, is growing, the price of organic products is the factor that largely limits consumers' purchasing choices. Many authors share this opinion, including Grzybowska-Brzezińska (2018), Trokhymchuk (2022), as well as Smoluk-Sikorska et al. (2024), who prove in their research that the most important barrier to the growth of organic food consumption is undoubtedly its high price, and to a lesser extent the quality or availability of this type of food. Therefore, when looking for the reasons for the high prices of organically produced food, it would be worth examining the reasons for the low popularity of organic farming in Poland. According to Borychowski (2023), “in Poland, the only EU country, the area of organic land fell from 655.5 thous ha to 509.3 thous ha between 2012 and 2020, i.e. by 22%. On average, the area of organic land in the EU as a whole increased by more than 55% during this period”. However, as the author states, it should be mentioned that in 2020, the area of organic farming in our country accounted for only about 4% of the agricultural land.

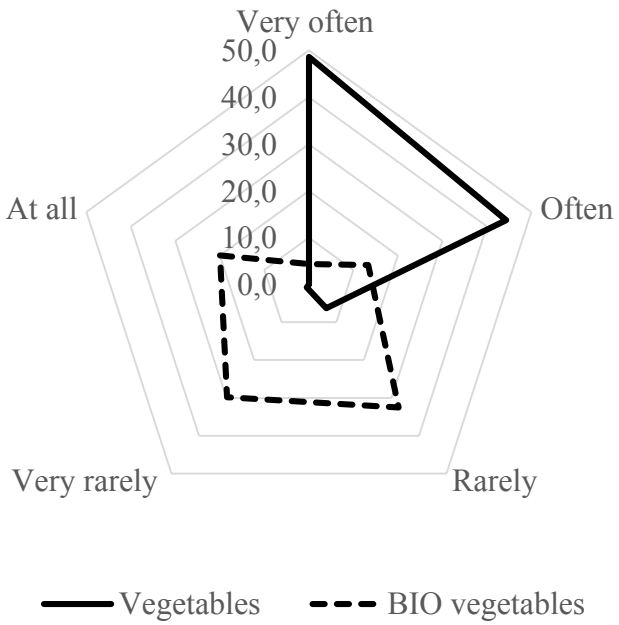

Figure 1. Frequency of vegetable purchases by respondents (in %).

Source: own research.

The analysis shows that the vast majority of respondents consumed vegetables daily, as indicated by 55.3% of respondents. Several times a week vegetables were consumed by 38.0% of respondents. Vegetables were consumed only once a week by 6.3% of opinion leaders. None of the respondents indicated that they consumed vegetables less than once a month (Figure 2).

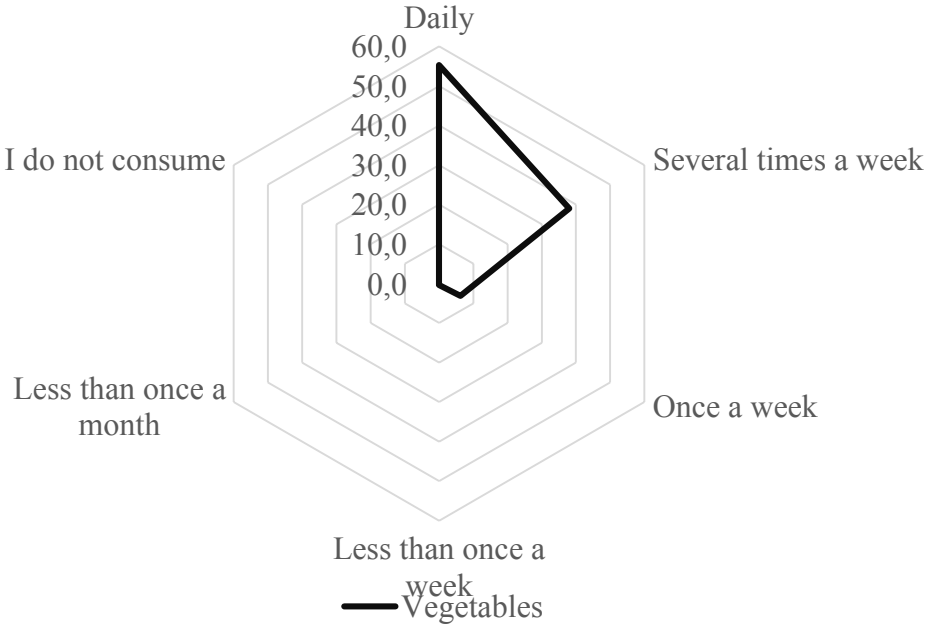

Figure 2. Frequency of vegetable consumption according to respondents (in %).

Source: own research.

Among the most frequently purchased vegetables were tomatoes and cucumbers. Purchases of these vegetables were indicated by 62.4 and 51.0% of respondents, respectively. Vegetables such as carrots, potatoes, lettuce and peppers were frequently purchased by 22.4 to 44.3% of respondents. Other frequently purchased vegetables, whose purchases were indicated by a total of 66.3% of survey participants, include onions, cabbage, broccoli, cauliflower, mushrooms, etc. (Figure 3). In a study conducted by Iowa et al. (2011), respondents indicated similarly, i.e. tomatoes, cucumbers and lettuce were their most frequently consumed vegetables.

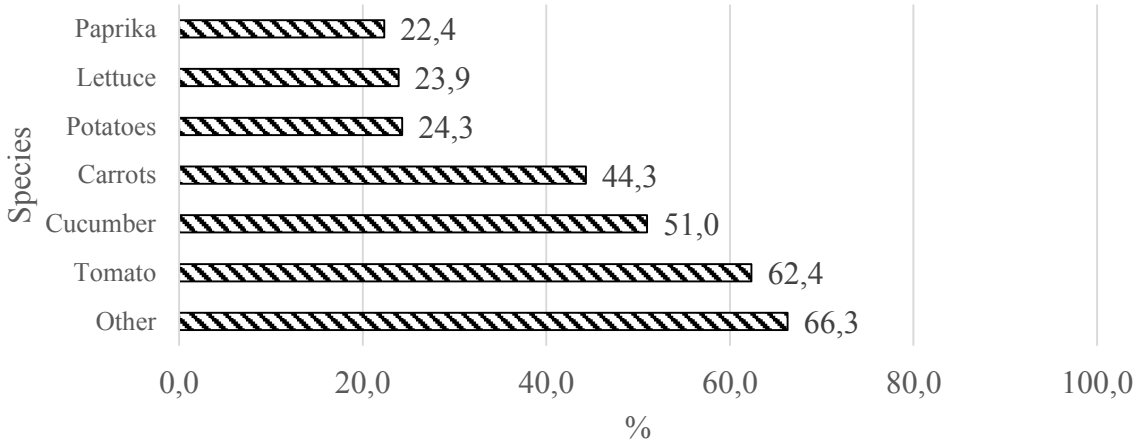

Figure 3. Most frequently purchased vegetables according to respondents (in %).
Source: own research.

According to the survey questionnaire, most consumers purchased vegetables very often (46.3%) and often (30.6%) from large grocery stores (i.e., hypermarkets, and discount stores). In contrast, respondents very rarely bought vegetables in small grocery stores (28.6%) and from street sales (27.8%). On the other hand, 31.0 and 25.5% of survey participants did not purchase there at all, respectively (Figure 4).

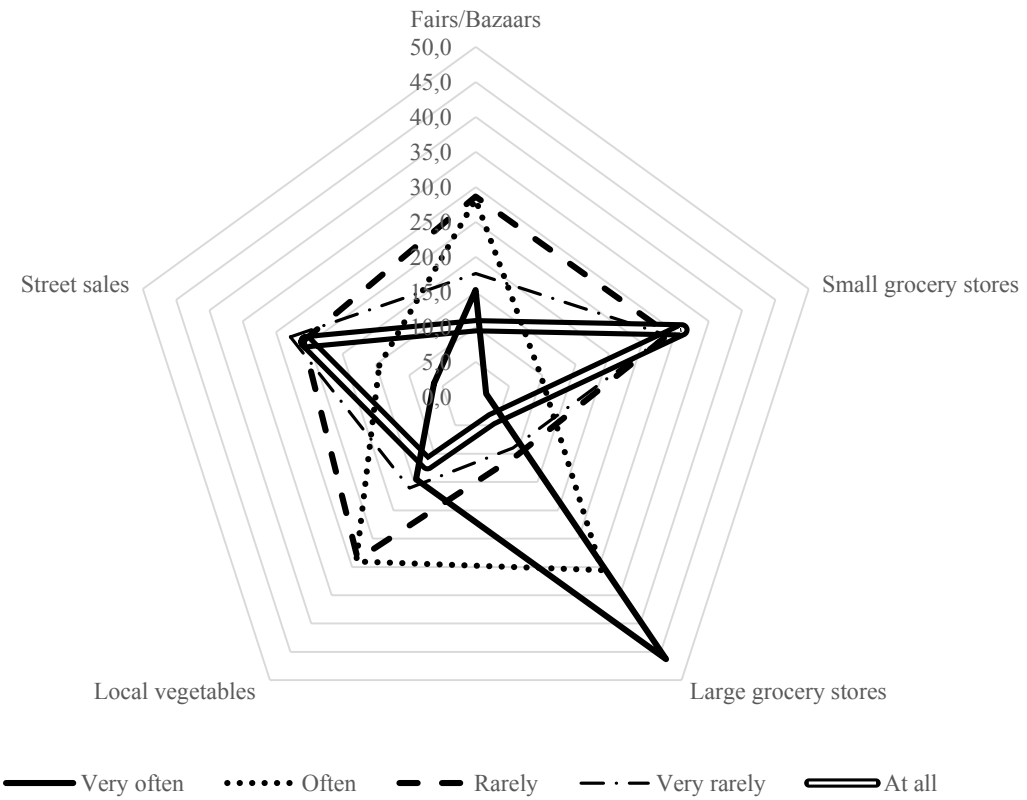

Figure 4. Frequency and location of vegetable purchases by respondents (in %).
Source: own research.

When buying vegetables, freshness and quality were the most important factors for 86.7 and 78.0% of respondents, respectively. Price was also an important factor for almost half of the respondents. Factors considered unimportant when buying vegetables turned out to be brand name and producer name. A study conducted by Kuren et al. (2022) on a group of 20-39-year-olds showed that respondents' opinions showed a positive attitude towards the health-promoting values of vegetables, despite the low frequency of consumption. The study showed that a higher frequency of vegetable consumption was associated with greater knowledge among respondents about their positive effects on health (Figure 5).

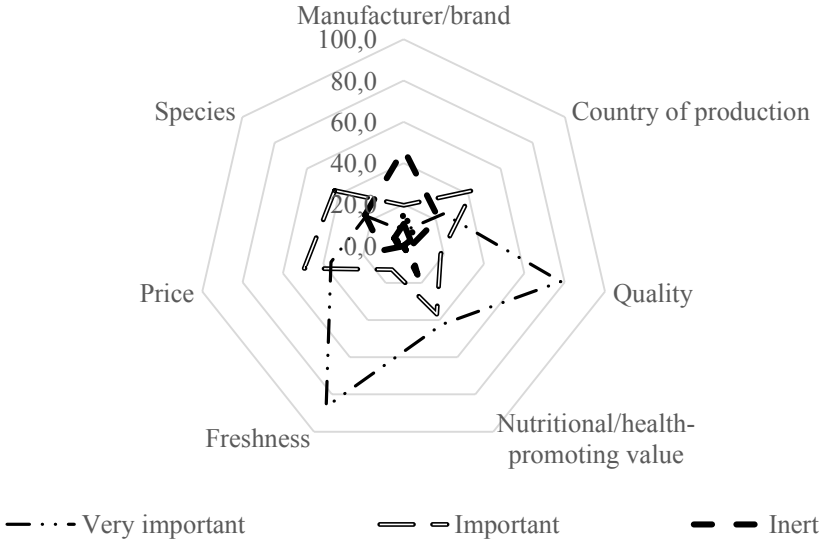

Figure 5. Factors influencing the purchase of vegetables by respondents (in %).

Source: own research.

The survey showed that of all the factors determining the choice of where to buy vegetables, the most important for respondents was the location near their place of residence, which was indicated by more than 70% of respondents. It is worth pointing out that this factor was more than 80% most often indicated by those over 60 years of age. It is noteworthy that low prices at the point of sale ranked only fourth among the factors for choosing where to buy vegetables, although it was indicated by more than 50% of respondents. More than 60% of respondents, concerning the purchase of vegetables, when choosing where to buy, were guided by the high quality of the products (65.9%) and the wide assortment of sales. On the other hand, the cleanliness of the store, discounts offered, helpful staff and advertising are factors that influence consumers' decisions to a lesser extent as to where to buy (Figure 6).

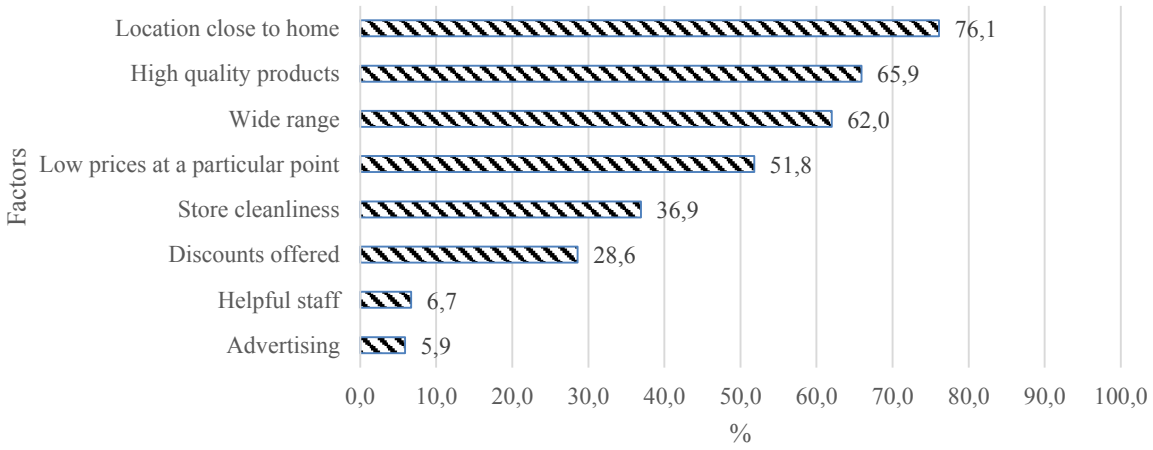

Figure 6. Factors influencing respondents' choice of where to buy vegetables (in %).

Source: own research.

The survey revealed that 34.1% of respondents spent between PLN 11 and PLN 20 on vegetable purchases in a single transaction. When analyzing the gender of the respondents, it was found that nearly 60% of both women and men allocated between PLN 11 and PLN 30 for their vegetable shopping at one time (see Table 2). Notably, 45.5% of respondents over the age of 60 spent between PLN 11 and PLN 20 for single purchases. In terms of income groups, a clear trend emerged: the higher the participants' income, the more they tended to spend on one-time vegetable purchases. Over 10% of individuals with incomes exceeding PLN 3,000 spent more than PLN 60 on vegetables in a single purchase, while among the other income groups, only 2.0% to 6.3% allocated such an amount.

The statistical analyses conducted did not reveal significant differences among specific groups of respondents, such as age, place of residence, and the frequency of spending money on vegetables. This conclusion is supported by the values obtained from the Z statistic, as well as the H statistic from the Mann-Whitney U tests and the Kruskal-Wallis ANOVA, along with the corresponding p-values. This suggests that, regardless of factors like age or place of residence, vegetables can be prioritized in grocery shopping.

Table 2.
One-time amounts that respondents spend on buying vegetables (in %)

Specification		Respondents' indications (in %)							Number n	Value of statistics	
		PLN 1-10	PLN 11-20	PLN 21-30	PLN 31-40	PLN 41-50	PLN 51-60	above 60 zł		p-value	Z or H*
Total		9,4	34.1	31.4	12.6	3.9	2.4	6.3	255		
Gender	K	7.2	37.3	31.4	15.0	2.6	2.6	3.9	153	0.4593	0.4593
	M	12.7	29.4	31.4	8.8	5.9	2.0	9.8	102		
Age	18-30 years	12.9	33.6	31.0	12.9	2.6	0.9	6.0	116	0.2645	3.9723
	31-45 years	7.8	32.5	32.5	14.3	5.2	1.3	6.5	77		
	46-60 years	2.5	32.5	40.0	7.5	5.0	5.0	7.5	40		
	Over 60 years old	9.1	45.5	13.6	13.6	4.5	9.1	4.5	22		
Education	Medium	11.0	31.9	27.5	16.5	3.3	1.1	8.8	91	0.1690	5.0392
	Professional	37.5	12.5	50.0	0.0	0.0	0.0	0.0	8		
	Higher	7.1	36.8	32.3	11.0	4.5	3.2	5.2	155		
Place of residence	Village	5.9	38.2	30.9	16.2	1.5	0.0	7.4	68	0.9045	1.0349
	City of up to 50 t. inhabitants	11.7	29.9	29.9	15.6	3.9	1.3	7.8	77		
	City of 51 to 99 t. inhabitants	0.0	33.3	53.3	0.0	0.0	6.7	6.7	15		
	City of 100 to 250 t. inhabitants	8.0	32.0	32.0	16.0	8.0	0.0	4.0	25		
	City of more than 250 t. inhabitants	12.9	35.7	28.6	7.1	5.7	5.7	4.3	70		
Monthly disposable income	Up to PLN 1000	37.5	37.5	6.3	12.5	0.0	0.0	6.3	16	0.0657	7.2037
	PLN 1001-2000	10.2	34.7	36.7	10.2	4.1	2.0	2.0	49		
	2001-3000 PLN	7.9	30.3	39.5	11.8	5.3	2.6	2.6	76		
	Pow. 3000 PLN	6.1	36.0	27.2	14.0	3.5	2.6	10.5	114		
Socio-economic situation	Student	12.1	34.8	39.4	12.1	0.0	0.0	1.5	66	0.2674	5.1996
	Self-employed	10.3	23.1	25.6	17.9	7.7	2.6	12.8	39		
	Company/office employee	6.6	36.1	32.0	11.5	4.9	2.5	6.6	122		
	Pensioner	10.0	45.0	15.0	15.0	5.0	10.0	0.0	20		
	Currently not working anywhere	25.0	25.0	25.0	0.0	0.0	0.0	25.0	8		

*Z for Mann-Whitney U, H for Kruskal-Wallis.

Sources: Own research.

Based on the analysis, it can be indicated that 63.5% of all respondents consumed the same amount of vegetables compared to the previous year. Considering the gender of the respondents, both women (64.1%) and men (62.7%) said they consumed the same amount of vegetables (Table 3). Considering age groups, each of the groups 18-30, 31-45, 46-60, and over 60 also bought the same amount of vegetables in 2023 compared to 2022. This was indicated by 56.9% to 81.8% of opinion leaders. For income groups, place of residence, and socioeconomic situation, no clear differences were observed in attitudes toward vegetable consumption compared to the previous year. A study conducted by Jąder (2015) shows that the highest consumption of vegetables was in the households of pensioners, married couples with no children, and those with the highest income. However, it is worth pointing out that 50.0% of students consumed the same amount of vegetables compared to the previous year, but almost 40% indicated that they consumed more.

In contrast, the statistical analyses carried out showed no significant differences, across groups characterizing the respondents and the one-time use of money to buy vegetables, as indicated by the values of the Z statistic and H of the Mann-Whitney U tests and Kruskal-Wallis ANOVA and p-value.

Table 3.
Amount of vegetables consumed by respondents compared to the previous year (in %)

Specification		Respondents' indications (in %)			Number n	Value of statistics	
		Read more	Less	As much		p-value	Z or H*
Total		24.3	12.2	63.5	255		
Gender	K	24.2	11.8	64.1	153	0.8393	0.2028
	M	24.5	12.7	62.7	102		
Age	18-30 years	33.6	9.5	56.9	116	0.0807	6.7403
	31-45 years	16.9	11.7	71.4	77		
	46-60 years	20.0	22.5	57.5	40		
	Over 60 years old	9.1	9.1	81.8	22		
Education	Medium	18.7	12.1	69.2	91	0.3656	3.1735
	Professional	25.0	0.0	75.0	8		
	Higher	27.7	12.9	59.4	155		
	Village	27.9	8.8	63.2	68		
Place of residence	City of up to 50 t. inhabitants	20.8	14.3	64.9	77	0.7343	2.0077
	City of 51 to 99 t. inhabitants	40.0	6.7	53.3	15		
	City of 100 to 250 t. inhabitants	12.0	12.0	76.0	25		
	City of more than 250 t. inhabitants	25.7	14.3	60.0	70		
Monthly disposable income	Up to PLN 1000	18.8	12.5	68.8	16	0.3468	3.3061
	PLN 1001-2000	28.6	18.4	53.1	49		
	2001-3000 PLN	22.4	11.8	65.8	76		
	Pow. 3000 PLN	24.6	9.6	65.8	114		
Socio-economic situation	Student	39.4	10.6	50.0	66	0.0949	7.9109
	Self-employed	28.2	12.8	59.0	39		
	Company/office employee	18.9	13.1	68.0	122		
	Pensioner	5.0	10.0	85.0	20		
	Currently not working anywhere	12.5	12.5	75.0	8		

*Z for Mann-Whitney U, H for Kruskal-Wallis.

Sources: Own research.

Based on the analysis, it can be indicated that as many as 74.9% of all respondents spent more cash on vegetable purchases compared to the previous year. A greater amount of cash than last year was spent on vegetable purchases by 77.8% of women and 70.6% of men (Tab. 4). Noteworthy are the age groups, each of which allocated a greater amount of cash for vegetable purchases. For income groups, place of residence, and monthly disposable income, no clear differences were observed in the allocation of cash for vegetables. Each of these groups allocated more compared to the previous year. It is noteworthy that for those currently not working anywhere more than 60% indicated that they allocated the same amount of cash for vegetable purchases than in the previous year and nearly 40% indicated that they allocated more.

The statistical analyses conducted showed significant differences in respondents' education, socioeconomic situation monthly disposable income per person in the household and the amount of cash allocated for vegetables about 2022, as indicated by the values of the Z statistic and the H of the Mann-Whitney U and Kruskal-Wallis ANOVA tests and p-values. The differences are that those with vocational and secondary education allocated the same amount of cash in the past year, while the vast majority of those with higher education, allocated more cash to purchase vegetables compared to the previous year. In the case of monthly income, those in the income group from PLN 1001 to 2000 stood out from the other income groups in that, the vast majority of them (85.7%) allocated more cash for the purchase of vegetables compared to the previous year, while the same amount of cash was allocated by only 24.1% of the opinion leaders in this group. Also, 77.0% of the employed and 71.8% of the self-employed allocated more cash for the purchase of vegetables compared to the previous year, while only 5.7% of the employed and 5.1% of the self-employed respondents allocated less.

Table 4.
The amount of money allocated to the purchase of vegetables by respondents compared to the previous year (in %)

Specification		Respondents' indications (in %)			Number n	Value of statistics	
		Read more	Less	As much		p-value	Z or H*
Total		74.9	6.3	18.8	255		
Gender	K	77.8	5.9	16.3	153	0.4974	-0.6785
	M	70.6	6.9	22.5	102		
Age	18-30 years	75.9	6.0	18.1	116	0.9071	0.5529
	31-45 years	75.3	6.5	18.2	77		
	46-60 years	72.5	5.0	22.5	40		
	Over 60 years old	72.7	9.1	18.2	22		
Education	Medium	67.0	4.4	28.6	91	**0.0011**	16.0734
	Professional	62.5	0.0	37.5	8		
	Higher	80.6	7.7	11.6	155		
	Village	73.5	4.4	22.1	68		
Place of residence	City of up to 50 t. inhabitants	75.3	6.5	18.2	77	0.7785	1.7671
	City of 51 to 99 t. inhabitants	93.3	0.0	6.7	15		
	City of 100 to 250 t. inhabitants	72.0	12.0	16.0	25		
	City of more than 250 t. inhabitants	72.9	7.1	20.0	70		

Cont. table 4.

Monthly disposable income	Up to PLN 1000	62.5	12.5	25.0	16	**0.0035**	13.6088
	PLN 1001-2000	85.7	10.2	4.1	49		
	2001-3000 PLN	68.4	2.6	28.9	76		
	Pow. 3000 PLN	76.3	6.1	17.5	114		
Socio-economic situation	Student	77.3	7.6	15.2	66	**0.0320**	10.5588
	Self-employed	71.8	5.1	23.1	39		
	Company/office employee	77.0	5.7	17.2	122		
	Pensioner	75.0	10.0	15.0	20		
	Currently not working anywhere	37.5	0.0	62.5	8		

*Z for Mann-Whitney U, H for Kruskal-Wallis.

Sources: Own research.

Based on the survey, 46.3% of all respondents definitely felt that the price of vegetables has increased compared to 2022. Considering gender, 56.2% of women felt the price increase very strongly and 51.0% of men felt the price increase only strongly (Table 5). Considering age groups, more than 80% of survey participants from all groups felt very strongly or strongly about the increase in vegetable prices compared to 2022. The same is true, respondents felt very strongly or strongly about the increase in vegetable prices regardless of where they lived, their monthly disposable income and even their socioeconomic situation.

The statistical analyses conducted, however, showed no significant differences, across groups characterizing respondents and perceptions of an increase in vegetable prices compared to 2022, as indicated by the Z-statistic and H values of the Mann-Whitney U tests and Kruskal-Wallis ANOVA and p-value.

Table 5.
Respondents' feelings were caused by the increase in vegetable prices compared to the previous year (in %)

Specification		Respondents' indications (in %)				Number n	Value of statistics	
		I feel very strongly	I feel strongly	I feel slightly	I don't feel		p-value	Z or H*
Total		46.3	40.0	12.2	1.6	255		
Gender	K	56.2	32.7	9.8	1.3	153	0.1083	-1.6057
	M	31.4	51.0	15.7	2.0	102		
Age	18-30 years	42.2	43.1	12.9	1.7	116	0.6185	1.7835
	31-45 years	51.9	37.7	9.1	1.3	77		
	46-60 years	55.0	30.0	12.5	2.5	40		
	Over 60 years old	31.8	50.0	18.2	0.0	22		
Education	Medium	46.2	36.3	17.6	0.0	91	0.4568	2.6038
	Professional	25.0	62.5	12.5	0.0	8		
	Higher	47.1	41.3	9.0	2.6	155		
	Village	44.1	44.1	10.3	1.5	68		
Place of residence	City of up to 50 t. inhabitants	46.8	37.7	14.3	1.3	77	0.4689	3.5597
	City of 51 to 99 t. inhabitants	40.0	46.7	13.3	0.0	15		
	City of 100 to 250 t. inhabitants	68.0	20.0	12.0	0.0	25		
	City of more than 250 t. inhabitants	41.4	44.3	11.4	2.9	70		
Monthly disposable income	Up to PLN 1000	62.5	25.0	12.5	0.0	16	0.1630	5.1226
	PLN 1001-2000	53.1	44.9	2.0	0.0	49		
	2001-3000 PLN	41.0	43.6	11.5	1.3	78		
	Pow. 3000 PLN	43.9	36.8	16.7	2.6	114		

Cont. table 5.

Socio-economic situation	Student	36.4	53.0	10.6	0.0	66	0.0603	9.0337
	Self-employed	46.2	28.2	25.6	0.0	39		
	Company/office employee	53.3	35.2	8.2	3.3	122		
	Pensioner	35.0	50.0	15.0	0.0	20		
	Currently not working anywhere	50.0	37.5	12.5	0.0	8		

*Z for Mann-Whitney U, H for Kruskal-Wallis.
Sources: Own research.

The above survey results are confirmed by a report by the Center for Public Opinion Research (CBOS) published in 2022 (Omyla, 2022), according to which Poles have been greatly affected by inflation. The most severe was the increase in food prices. According to the research published in this report, respondents reduced their daily purchases and used substitutes.

5. Summary and conclusions

Vegetables, like fruits, are among one of the basic and most important foods. Hence, according to the latest dietary recommendations, these products have been ranked first in the pyramid of human nutrition. Demand for vegetables is increasingly linked to the increase in consumer awareness of their health-promoting properties. Hence, it is assumed that a change in consumption patterns should contribute to an increase in the consumption of this food group. In addition, the progressive development and introduction of innovations in manufacturing techniques, modern supply chains and new types of packaging have resulted in the possibility of offering consumers vegetables with a longer shelf life, without losing their sensory qualities, and, through their processing and foreign trade, their availability practically throughout the year.

Changes in the structure of vegetable consumption in Poland have been recorded throughout the studied multi-year period. The macroeconomic analyses carried out showed that although the consumption of vegetables and processed vegetables, in general, showed a slight downward trend from 2015 to 2022, the highest growth rate was recorded for processed and frozen vegetables and the group of other vegetables. While a negative rate of change was recorded for all other categories of the vegetable groups analyzed.

Research results show that consumers are consuming more and more processed vegetables and frozen vegetables that are suitable for direct consumption or whose pre-processing significantly reduces meal preparation time. Thus, it is a food of convenience for the consumer. In turn, the positive growth rate in the consumption of vegetables from the group of other vegetables shows that consumers are looking for more and more new flavors, expanding the

range of fresh vegetables consumed, which are often available all year round, despite high prices.

According to the survey, the most frequently consumed vegetables among respondents were tomatoes, cucumbers and carrots. Most respondents purchased vegetables very often. Purchases were mainly made at hypermarkets and discount grocery stores. Slightly less important were markets and local vegetable stores. In addition, the most important factor in respondents' choice of where to buy vegetables was the location near their place of residence, which was indicated by more than 70% of respondents. A significant proportion of respondents chose places that offered a wide assortment and high-quality produce. When shopping, respondents paid particular attention to the freshness and quality of vegetables, while only in third place was the price.

Based on the analysis, it can be pointed out that nearly half of all respondents were very much affected by the increase in vegetable prices caused by high inflation in Poland. Although they allocated more funds for the purchase of vegetables compared to the previous year, this did not translate into an increase in their consumption. This indicates that the amount of vegetables consumed is due to certain eating habits of consumers, and the price increase contributed to their search for more affordable substitute products. Thus, the study also shows that the price is not the most important factor determining the level of vegetable consumption, but largely influences the assortment of vegetables consumed, or their preparations.

Particularly noteworthy is the fact that only a little more than half of the respondents consume vegetables every day, that is, as indicated by nutrition standards. Which proves that there is still a lot of work to be done in terms of nutrition education of the public, especially since the average consumption of vegetables in Poland is far from the European average.

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