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Polish young adult consumers' purchasing behaviours and preferences towards strawberries

Zachowania zakupowe i preferencje polskich młodych dorosłych konsumentów dotyczące truskawek

Abstract. This study surveyed 203 Polish consumers aged 18–25 to analyse their strawberry buying and consumption patterns and preferences. The research employed a quantitative survey (CAWI) and qualitative sensory assessment. The study found that strawberry consumption is highly seasonal, with higher intake in summer, particularly among women, while winter consumption was influenced by income level. Key purchase drivers included the appearance and aroma of strawberries; less important in choosing strawberries were price, type of packaging, place of purchase, and country of origin. Sensory evaluation of four strawberry cultivars – Lycia, Aprica, Giusy, and Klodia – revealed Klodia as the most favourable in sweetness and flavour, though Aprica was visually preferred. These findings suggest that visual preferences do not always align with sensory qualities when selecting strawberries.

Keywords: strawberry consumption, consumer preferences, sensory evaluation, seasonality, purchase behaviour

INTRODUCTION

Fruits and vegetables are a desirable element of our diet. Health organisations recommend their daily consumption; for example, the WHO suggests eating five servings daily, totalling around 400 g [Bieniek 2022]. The primary benefit of consuming fruits and vegetables is their nutritional and health properties. According to Stea et al. [2020], low intake of fruits and vegetables is associated with a higher risk of cardiovascular diseases, type 2 diabetes, and cancer, which ultimately contributes to increased mortality. According to WHO estimates, insufficient fruit consumption contributes globally to approximately 14% of deaths from stomach or intestinal cancer, 11% of deaths from ischemic heart disease, and 9% of deaths due to stroke [Pukszta and Platta 2017].

Strawberries are among the fruits that can bring significant health benefits [Giampieri et al. 2013, 2015, Miller et al. 2019]. These fruits are a valuable source of many minerals such as potassium, phosphorus, calcium, magnesium, iron, zinc, manganese [Gondek et al. 2020], and vitamins C, A, B1, B2, B3, B6, E, and folic acid. They provide the body with considerable amounts of pectin and dietary fibre while being low in calories [Kopytowski et al. 2006, Zdrojewicz et al. 2017]. As noted by Abbaspour [2013], the iron found in strawberries is a valuable component for individuals struggling with anaemia, as it supports blood-forming processes. The structure and chemical composition of the fruit makes strawberries versatile for various applications. For example, using strawberry fruit extract can provide a whitening effect on discoloured teeth and is the best alternative compared to synthetic tooth whiteners [Ita et al. 2019]. The high content of vitamin C in strawberries, which is an active antioxidant [Odriozola-Serrano et al. 2008, Janda et al. 2015], as well as other antioxidant compounds such as flavonoids (mainly anthocyanins), ellagic acid [Pinto et al. 2008], and fisetin [Khan et al. 2013], is particularly noteworthy. Ellagic acid is currently attracting attention due to increasing evidence of its chemopreventive and antioxidant effects. At the same time, fisetin is a potent senolytic that slows down ageing processes [Zdrojewicz et al. 2017, Dudkowska 2023], reduces inflammation in the nervous system, protects against stroke and memory disorders, and alleviates symptoms of depression [Kim et al. 2016]. The chemical composition of strawberries accounts for their anticancer, anti-inflammatory, antiviral, antibacterial, anti-atherosclerotic, anti-thrombotic, anti-allergic, and anti-cholesterol effects [Pukszta and Platta 2017].

Poland is a significant producer of strawberries globally and within the European Union. According to data from the Central Statistical Office [GUS 2024b], in 2023, strawberries accounted for 32.4% of the national production of berry fruits. Between 2010 and 2022, strawberry harvests ranged from 150,000 to 200,000 t, with 96% coming from conventional farming. In 2022, Poland ranked 8th in the world in strawberry production and 2nd in the European Union, right behind Spain [own calculations based on FAO data]. The widespread cultivation of strawberries in Poland is due to favourable climatic and soil conditions for their growth, high demand for fresh strawberries, which comprise more than half of the production volume, and processed strawberries [Zmarlicki and Brzozowski 2020]. Strawberry consumption in Poland is estimated at around 4 kg per person per year. The growing demand for strawberries among Polish consumers is driven by their taste, health benefits, and continuous supply, while the relatively high price is a limiting factor for consumption [Zmarlicki and Brzozowski 2020].

To the authors' knowledge, Polish consumers' purchasing behaviours and preferences in the strawberry market have not yet been analysed.

To fill this gap and additionally explore the alignment between the visual acceptance of strawberries and their sensory evaluation, a study was conducted with the following objectives:
− an analysis of consumer behaviour and preferences regarding strawberries, including consumption frequency, factors influencing fruit choice, preferences for strawberry characteristics (colour, appearance, shape), price levels acceptation, and packaging preferences;
− an evaluation of consumer preferences for selected strawberry cultivars based on their external appearance and sensory characteristics such as taste, aroma, juiciness, and firmness.

In the context of the research objectives presented above, the following research questions were formulated:

1. How does the frequency of strawberry consumption among young consumers vary by season, and to what extent is it influenced by gender, income, and place of residence?

2. Which factors are most important to young consumers when purchasing strawberries, and how do they rank external appearance, aroma, price, packaging type, organic cultivation, and Polish origin in their decision-making process?

3. Do young consumers accept higher prices for strawberries in the winter season compared to summer?

4. What type of strawberry packaging do young consumers prefer, and how do they perceive plastic versus natural packaging materials?

5. Which characteristics of strawberry appearance – such as size, color, and shape – are most preferred by young consumers?

6. Do young consumers' preferences for the external appearance of different strawberry cultivars align with their evaluation of sensory qualities?

MATERIAL AND METHODS

To achieve the research objective, a quantitative study was conducted in the spring of 2024 using the CAWI (Computer Assisted Web Interview) method, and a qualitative research in the summer of 2024 using organoleptic evaluation.

In both studies, the respondents were individuals aged 18–25. There were three main reasons for selecting a sample of young people for the study – first, young people, having constant access via social media to vast amounts of information about the market, products, and consumption behaviour of others, are much more informed than older generations, and, as a result, are more aware of their market choices [Cochoy et al. 2020]. Second – young consumers are more sensitive to environmental issues, which is reflected in their purchasing decisions [Bernaciak et al. 2021]. Third – these consumers will soon form the primary target group for the food market, so understanding their preferences in advance is particularly important [Park 2021]. Both studies involved only individuals who gave informed consent to participate.

Survey research

The research questionnaire consisted of a demographic section, which included questions about gender, place of residence, and income, and a substantive section that addressed the following areas:
– strawberry consumption frequency (in summer and in winter) – closed, nominal scale,
– determinants of strawberry choice – scale from 1 (most important) to 7 (least important), preferences for fruit appearance (colour, shape, size) – closed, nominal scale,
– perception of strawberry characteristics by packaging type (fig. 1) – closed, nominal scale,
– preferences for external features of strawberry varieties (Lycia, Aprica, Giusy, Klodia) – scale from 1 (most preferred) to 4 (least preferred) – fig. 2.

Option 1	Option 2

Fig. 1. Photographs of strawberries in two commercial packages: option 1 in plastic packaging and option 2 in a wooden container
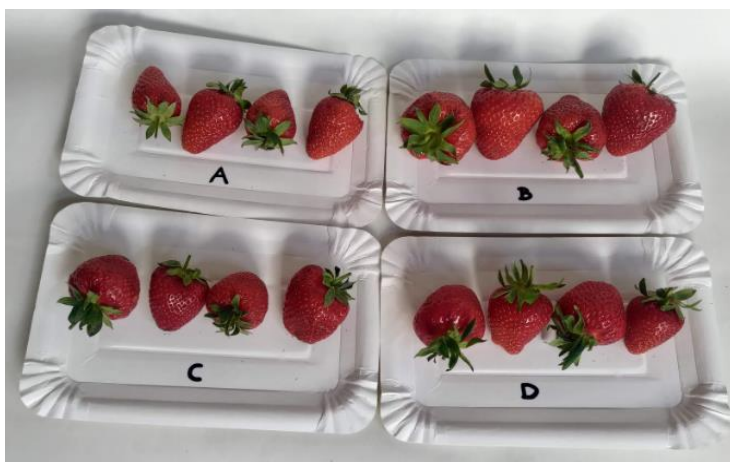
Fig. 2. Strawberry cultivars subjected to preference evaluation: A – Lycia, B – Aprica, C – Giusy, D – Klodia

The study involved 203 respondents. Over 75% of the participants were women. In terms of place of residence, the majority of respondents (over 44%) lived in cities with a population of over 500,000, 30.6% lived in towns with up to 500,000 residents, while

one in four respondents lived in rural areas. As for income, 9.4% of respondents opted not to provide an answer, while the remaining respondents were evenly distributed across three income brackets: up to 2500 PLN per person, from 2500 to 4500 PLN per person, and above 4500 PLN per person (tab. 1).

Table 1. Characteristics of the research sample (data in %)

Gender		Place of residence			Monthly net income per person in the household			
women	men	village	city with up to 500,000 residents	city with over 500,000 residents	up to 2500 PLN	2501–4500 PLN	over 4500 PLN	no answer
75.9	24.1	25.1	30.6	44.3	30.0	30.1	30.5	9.4

The statistical analysis of data obtained from the quantitative study included descriptive statistics and analysis using non-parametric tests. The Kruskal–Wallis ANOVA test (K–W) was used to compare income levels and place of residence for questions constructed using the ordinal scale. In contrast, the Mann–Whitney U test (M-W) was applied for comparisons based on gender. Pearson's Chi-square test (Chi²) was employed for single-choice questions to assess dependencies concerning gender, place of residence, and income. A significance level of $p < 0.05$ was accepted for all tests. The effect size (η^2) was calculated to determine statistically significant results to evaluate the magnitude of the observed effect or the differences between groups. In all instances of statistically significant findings, the effect size was moderate, which suggests a substantial cognitive value in the results obtained [Fritz et al. 2012]. The Statistica 13.3 program was used for the analyses.

Sensory evaluation

The sensory evaluation focused on four cultivars of strawberries: Lycia, Aprica, Giusy, and Klodia. To ensure objectivity in the assessment, each array was represented by samples of strawberries with a uniform level of ripeness, carefully washed and dried. The samples were presented in identical containers (fig. 2).

Each of the 29 participants in the study received samples of strawberries, which they evaluated according to a predetermined set of criteria concerning aroma (sweet, sour, typical strawberry), juiciness, firmness, and taste (sweet, sour, typical strawberry). Participants rated the intensity of each feature on a linear scale of 10 cm, where 0 cm indicated the absence of the analysed feature and 10 cm indicated the highest intensity. As part of the statistical analysis, average ratings for each evaluated feature were calculated, followed by comparisons of results regarding the individual strawberry cultivars. To identify statistically significant differences between cultivars, an analysis of variance (ANOVA) was conducted, and in cases where statistically significant differences were detected, post-hoc tests (Tukey's test) were performed.

RESULTS

Frequency of strawberry consumption in the summer and winter season

In the summer season, the largest group of respondents (49.3%) consumed strawberries several times a week, and over one-third of respondents (34.5%) consumed strawberries once a week. Additionally, 5.9% of participants said they consumed them once a month, 5.4% indicated "once per season" and nearly 5% stated that they consumed strawberries daily. None of the participants reported that they ever consumed strawberries. Statistical analysis showed significant differences in the frequency of strawberry consumption during the summer season based on gender – women reported a higher frequency of strawberry consumption (tab. 2).

Table 2. Frequency of strawberry consumption in the summer season considering gender, place of residence, and income

Frequency of consumption	Responses (%)	Gender (p^*, η^2)	Place of residence (p^{**})	Income (p^{**})
Never	0			
Once per season	5.4			
Once a month	5.9			
Once a week	34.5	0.01	0.79	0.09
Several times a week	49.3			
Daily	4.9			

* Mann–Whitney U test, ** Kruskal–Wallis ANOVA test

In the winter season, more than one-third of respondents (36%) declared that they do not consume strawberries during this time. Nearly 40% of participants consumed strawberries only once during the entire season, and 19.2% consumed them monthly. Higher frequencies of consumption were not reported. In the winter season, income was the determining factor for higher consumption frequency – individuals with incomes between 2500 and 4500 PLN most frequently consumed strawberries during this period (tab. 3).

Table 3. Frequency of strawberry consumption in the winter season considering gender, place of residence, and income

Frequency of consumption	Responses (%)	Gender (p^*, η^2)	Place of residence (p^{**})	Income (p^{**})
Never	36.0			
Once per season	39.3			
Once a month	19.2			
Once a week	3.0	0.54	0.18	0.01
Several times a week	2.5			
Daily	0.0			

* Mann–Whitney U test, ** Kruskal–Wallis ANOVA test

Determinants of strawberry purchasing

The respondents identified the most critical factors for selecting strawberries as appearance (mean score of 3.63) and aroma (3.60). Following these, the factors ranked in order of importance were price (3.77), packaging (3.86), place of purchase (3.94), country of origin (3.98), and place of sale (3.94). The least significant factor for respondents was information on the packaging (4.02). It was noted that the importance of the place of purchase increased with income, and the country of origin of the strawberries was significantly more important for women (tab. 4).

Table 4. Importance of factors influencing strawberry purchases based on gender,
place of residence, and income

Important features	Average	Gender ($p*$)	Place of residence ($p**$)	Income ($p**$)
Appearance	3.63	0.86	0.18	0.38
Aroma	3.69	0.25	0.10	0.61
Price	3.77	0.41	0.62	0.52
Packaging	3.86	0.93	0.34	0.71
Place of purchase	3.94	0.75	0.35	0.04
Country of origin	3.98	0.00	0.85	0.93
Information on the packaging/ at the point of sale, e.g. about flavour	4.02	0.84	0.88	0.37

* Mann–Whitney U test, ** Kruskal–Wallis ANOVA test

Willingness to pay for strawberries in summer and winter seasons

In the summer season, the largest group of respondents (31.5%) were willing to pay between 8 and 10 PLN per kilogram of strawberries, while 26.6% preferred prices in the range of 10–12 PLN. A much smaller portion (17.7%) was ready to pay between 6 and 8 PLN, and only 4.9% of respondents indicated the lowest price range – up to 6 PLN (tab. 5).

Table 5. Accepted price per kilogram of strawberries in the summer season

Accepted price per kilogram (PLN/EUR)	Responses (%)
Up to 6/1.39	4.9
6–8/1.39–1.86	17.7
8–10/1.86 –2.31	31.5
10–12/2.31–2.77	26.6
12–15/2.77–3.46	9.4
Over 15/3.46	1.0
The price is not necessary to me	7.9
I do not buy d uring this period	1.0

In the winter season, the highest percentage of respondents (21.2%) indicated a preferred price range of 12 to 17 PLN per kilogram; 11.3% considered a price from 8 to 12 PLN acceptable. In comparison, less than 4% of respondents indicated other price ranges, and more than half (52.7%) declared they did not buy strawberries during this period (tab. 6). No statistically significant relationship was found between gender, place of residence, and income of the respondents and their preferences regarding strawberry price levels.

Table 6. Accepted price per kilogram of strawberries in the winter season

Accepted price per kilogram (PLN/EUR)	Responses (%)
Up to 8/1.86	3.9
8–12/1.86–2.77	11.3
12–17/2.77–3.93	21.2
17–22/3.93–5.08	3.0
Over 22/5.08	1.5
The price is not necessary to me.	6.4
I do not buy during this period.	52.7

Both in the summer and winter seasons, no statistically significant relationship was found between respondents' preferences regarding strawberry price levels and gender, place of residence, and income level.

Preferences towards strawberry packaging

Respondents were asked to evaluate the characteristics of strawberries placed in two different types of packaging – a wooden punnet and a plastic container (fig. 1). Strawberries in the wooden punnet were statistically significant ($p < 0.05$) and more often perceived as being directly from the farmer, associated with Polish origin, considered fresh, and seen as organic. On the other hand, respondents more frequently perceived strawberries in plastic containers as being more expensive (tab. 7). There was no variation in the respondents' opinions based on gender, place of residence, or income level.

Table 7. Perception of strawberry characteristics in plastic packaging and wooden punnet

Strawberry characteristics	Strawberries in plastic packaging (%)	Strawberries in wooden crates (%)
Come from Poland	6.9	93.1
More expensive per kilogram	71.4	28.6
Fresher	9.9	90.1
Organic	14.8	85.2
Straight from the farmer	3.0	97.0

Preferences towards colour, shape and size of strawberries

Respondents were asked to specify their preferences regarding strawberries' colour, shape, and size. Concerning the colour of the fruit, regardless of gender, place of residence, and income, respondents most frequently preferred strawberries in a red colour (74.4%) (tab. 8).

As for the shape, most respondents (66.5%) stated that this feature was irrelevant, while 21.7% indicated a preference for a conical shape (tab. 9).

The size of strawberries was unimportant for 46.8% of respondents, 35% preferred medium-sized fruits, with respondents from cities of up to 500,000 inhabitants significantly more likely to choose this answer, while 17.7% preferred large strawberries (tab. 10).

Table 8. Respondents preferences regarding strawberry colour

Strawberry colour	Responses (%)
Red	74.4
From pink to light red	19.6
Light pink	2.5
Not important	3.5

Table 9. Respondents preferences regarding the shape of strawberries

Strawberry shape	Responses (%)
Conical	21.7
Rounded	1.5
Spindle-shaped	2.4
Irregular	6.4
Spherical	1.5
Not important	66.5

Table 10. Respondents preferences regarding the size of strawberries by gender, place of residence, and income

Strawberry size	Responses (%)
Large	17.7
Medium	35.0
Small	0.5
Not important	46.8

*Pearson Chi² test

There was no variation in the respondents' opinions about the colour, shape, and size of strawberries based on gender, place of residence, or income level.

Evaluation of external characteristics of selected strawberry cultivars

Among the four evaluated by appearance strawberry cultivars (Lycia, Aprica, Giusy, and Klodia) – fig. 2, the most preferred cultivar by respondents was Aprica (mean score 2.12). A lower preference level (2.20) was recorded for the cultivar Giusy, followed by Klodia (2.27). The least accepted variety was Lycia, with a mean score of 3.41. The differences in the ratings of the individual varieties were statistically significant.

Table 11. Respondents visual preferences for selected strawberry cultivars considering gender, place of residence, and income, and the ratings of strawberries by cultivar with p-values for the significance of differences between varieties, gender, place of residence, and income

Cultivars	Average rating	For comparison between cultivars ($p*$)	Gender ($p**$)	Place of residence ($p***$)	Income ($p***$)
Lycia	3.41		0.21	0.49	0.79
Aprica	2.12	0.00	0.65	0.95	0.02
Giusy	2.20		0.92	0.11	0.00
Klodia	2.27		0.38	0.98	0.88

* ANOVA Friedman test; ** Mann–Whitney U test, *** Kruskal–Wallis ANOVA test

Considering the demographic and economic characteristics of the respondents, statistically significant variation in the ratings of different cultivars was observed only for the cultivars Aprica and Giusy concerning income level. As income increased, the preference for the Aprica cultivar increased, while the acceptance of the Giusy cultivar decreased (tab. 11).

Evaluation of sensory characteristics of selected strawberry cultivars

As part of the organoleptic study, respondents evaluated the aroma, juiciness, firmness and taste of the strawberry cultivars assessed for appearance in the survey.

The results of the aroma evaluation showed that for the sweet aroma, the highest rating was given to the Klodia cultivar (4.90). At the same time, the lowest score was assigned to the Aprica cultivar (3.57). Aprica received the highest score (3.04) for the sour aroma, and Lycia the lowest (2.44). Regarding the strawberry aroma, the Giusy cultivar was rated the highest (5.16), while Klodia scored the lowest (4.49). The differences in the ratings for all aroma types were not statistically significant. Regarding juiciness, the Lycia variety obtained the highest average rating (6.88), followed by Aprica (6.31), Klodia (5.84), and Giusy (4.30). The differences between cultivars of juiciness were statistically significant.

Giusy received the highest rating (6.22) for firmness, and Lycia the lowest (4.06). The firmness of Klodia was rated at 4.62, and Aprica at 4.11. These differences were statistically significant.

Sweet, sour, and strawberry flavours were considered in terms of taste. For sweetness, Klodia received the highest rating (5.68), while Giusy received the lowest (4.85). The differences in sweetness ratings between the cultivars were not statistically significant. For the sour taste, Aprica was rated the highest (4.74), followed by Lycia (4.56), with

Giusy receiving a score of 3.47 and Klodia 3.16. Regarding the strawberry taste, Klodia was rated the highest (6.44), followed by Lycia (5.78), with Aprica scoring 4.61 and Giusy 4.10. The differences in sour and strawberry taste ratings among the cultivars were statistically significant (tab. 12).

Table 12. Results of the organoleptic evaluation of the strawberry cultivars Lycia, Aprica, Giusy, Klodia

Sensory characteristics		Lycia	Aprica	Giusy	Klodia	p^*
Aroma	sweet	4.64	3.57	4.79	4.9	0.32
	sour	2.44	3.04	2.77	2.49	0.75
	strawberry	4.86	4.55	5.16	4.49	0.83
Juiciness		6,88	6.31	4.30	5.84	0.00
Firmness		4,06	4.11	6.22	4.62	0.00
Taste	sweet	4.94	5.27	4.85	5.68	0.82
	sour	4.56	4.74	3.47	3.16	0.01
	strawberry	5.78	4.61	4.10	6.44	0.00

* Analysis of variance (ANOVA)

To assess the differences between the cultivars, Tukey's HSD (Honestly Significant Difference) test was conducted for characteristics with statistically significant ratings (juiciness, firmness, sour taste, and strawberry taste).

Regarding juiciness, the Giusy cultivar was rated significantly lower than the others. This cultivar was also rated significantly firmer. The Klodia cultivar received a significantly lower rating for sour taste than the Aprica cultivar. Regarding strawberry taste, both the Lycia and Klodia cultivars received the highest ratings. According to the survey participants, the Klodia cultivar was characterised by a more intense strawberry flavour compared to the Aprica and Giusy cultivar. In contrast, the Lycia cultivar had a more robust strawberry flavour than Giusy (tab. 13).

Table 13. Results of Tukey's HSD Tests for juiciness, firmness, sour taste, and strawberry taste for the four analyzed strawberry cultivars

Comparison between cultivars	Juiciness p^*	Firmness p^*	Sour taste p^*	Strawberry taste p^*
Lycia (A) vs Aprica (B)	0.75	1.00	0.99	0.28
Lycia (A) vs Giusy (C)	0.00	0.00	0.20	0.05
Lycia (A) vs Klodia (D)	0.26	0.69	0.06	0.73
Aprica (B) vs Giusy (C)	0.00	0.00	0.10	0.86
Aprica (B) vs Klodia (D)	0.84	0.75	0.03	0.03
Giusy (C) vs Klodia (D)	0.04	0.01	0.95	0.00

* Tukey's honestly significant difference (HSD) test

DISCUSSION

The results obtained allowed for the achievement of the stated research objectives. Regarding consumer behaviours, it was found that during the summer season, strawberries are most often consumed once or several times a week, while in winter, they are consumed once during the season or not at all. The seasonality of strawberry consumption, caused by the higher price of the fruit and the fact that they come from other countries or are grown in tunnels, has also been confirmed by other studies [Bhat et al. 2015, Roalmer 2022]. At the same time, the study conducted by Kamińska [2024] among a group of 189 students showed that, out of 23 fruit species listed in the survey, strawberries were the favourite fruit for as many as 67.2% of young consumers. Additionally, research conducted in 2023 [KZGPOiW 2023] indicated that strawberries are among the most sought-after seasonal fruits.

A statistically significant factor differentiating strawberry consumption in the summer was gender – women declared more frequent consumption. In contrast, in the winter season, respondents with a medium income level declared the most frequent consumption. The influence of gender and income on strawberry consumption was also noted in studies by Bhat et al. [2015], while Stea et al. [2020] reported generally higher fruit and vegetable consumption among women. The place of residence did not differentiate the frequency of strawberry consumption. However, the results of the GUS Household Budgets Survey [GUS 2024a] indicate that residents of large cities declare the highest consumption of berries.

The survey results indicate that for respondents the appearance and aroma of these fruits are considered the most important factors in choosing strawberries; less important determinants of choice were price, type of packaging, organic cultivation of the fruits, and country of origin. Findings on the key importance of taste and smell when buying strawberries are confirmed by other studies [Fan et al. 2021, Aoki and Akai 2023].

Price ranked fourth in strawberry purchasing factors, and its preferred level was lower in the summer than in the winter seasons. The sensitivity of consumers to strawberry prices is supported by research conducted by Sparacino et al. [2024], in which the Price Conscious segment constituted the most significant percentage (35%) of respondents. The variability in price preferences depending on the season is also supported by the study by Bhat [2015].

Packaging ranked fourth among the determinants of strawberry choice, while the information on it was found to be the least significant factor for respondents. The study by Sparacino et al. [2024] also showed the relatively low importance of packaging when purchasing strawberries, while analyses by Ruth and Rumble [2016] indicated a marginal effect of the information on packaging on consumers' purchasing decisions. A survey showed that packaging influences the perception of strawberries: those in wooden crates were seen as domestic, fresh, organic, and farm-sourced, while strawberries in plastic packaging were considered more expensive. The effect of packaging type on the perception of fresh food products was also found in a study by Ruth and Rumble [2016].

The place of purchase was moderately important for young Poles, similar to findings by Bhat et al. [2015] and Wang et al. [2017]. In studies by Bhat et al. [2015] concerning respondents from Germany, it was found that the preferred place to purchase strawberries

is large grocery stores, while Wang et al. [2017] noted that the segment of young consumers in the USA is more inclined than other groups to purchase strawberries at farmers' markets.

The country of origin proved moderately important for Polish consumers. The mild significance of this factor was also noted in studies by Roberts et al. [2021], Saracino et al. [2024], Bhat et al. [2015] and Wang et al. [2017].

Regarding respondents' preference for external features of strawberries, it was noted that young consumers prefer red-coloured, middle-sized, and conical-shaped fruits. The preference for the red colour of strawberries is confirmed by studies conducted by Aoki and Akai [2023] and Stea et al. [2020]. Whereas higher acceptance for oval and large strawberries was also found in studies by Wang et al. [2017] and Bhat et al. [2015].

When evaluating selected strawberry cultivars based on appearance, the respondents participating in the survey found the Aprica cultivar to be the most attractive, with a lower level of preference for the Giusy cultivar, the Klodia cultivar ranked next, and the least acceptable was the Lycia cultivar. However, an analysis of the sensory characteristics (aroma, juiciness, firmness, and taste) of the same fruit cultivars showed that considering the previously identified [Kim et al. 2016, Wendin et al. 2019, Fan et al. 2021], quality traits of strawberries, the most attractive cultivar is Klodia, rated by respondents as the sweetest, with the most intense strawberry flavour, moderately juicy, and the least acidic. The observed discrepancy in respondents' preferences regarding the appearance and sensory characteristics of the fruit suggests that the choice of strawberries based on visual attributes does not align with the preferred sensory properties of these fruits.

CONCLUSIONS

The study on strawberry consumption in Poland revealed significant insights into young consumer behaviour. Significant seasonality in consumption was found, with statistically significant factors differentiating strawberry consumption in the summer gender and income. The survey results also indicate that for young respondents the appearance and aroma of strawberries are the most important factors in choosing the fruit; less important determinants of choice were price, type of packaging, organic cultivation of the fruits, and country of origin. It was found that young respondent's price sensitivity varies by season – they are more willing to pay higher prices for strawberries in winter than in summer. It was also that young consumers' perceptions of strawberry quality depended on the type of package – wooden containers were associated with local and fresh attributes, while the fruit in plastic packaging was considered more expensive. Regarding young respondents' preference for external features of strawberries, it was noted that young consumers prefer red-coloured, middle-sized, and conical-shaped fruits. Sensory evaluation of four new strawberry cultivars – Lycia, Aprica, Giusy, and Klodia – revealed Klodia as the most favourable in sweetness and flavour, though Aprica was visually preferred by young respondents. These findings indicate that visual preferences may not always align with expected sensory qualities when selecting strawberries.

These insights offer valuable guidance for marketing strategies and supply chain management.

This study has several limitations. First, the survey method relied on self-reported data, which may introduce potential biases. Furthermore, the small sample size limits the generalizability of the findings, and the emphasis on young consumers means that the results may not accurately represent other age groups. To enhance future research, it would be beneficial to include a more diverse sample to provide a broader understanding of consumer preferences.

REFERENCES

Aoki K., Akai K.A., 2023. A comparison between Spain and Japan concerning the colour, expected taste scale, and sustainability of strawberries: A Choice Experiment. Food Qual. Prefer. 103, 104671. https://doi.org/10.1016/j.foodqual.2022.104671

Bhat R., Geppert J., Funken E., Stamminger R., 2015. Consumers perceptions and preference for strawberries – a case study from Germany. Int. J. Fruit Sci. 15(4), 405–424. https://doi.org/ 10.1080/15538362.2015.1021408

Bieniek M., 2022. Konsumpcja owoców i warzyw w Unii Europejskiej oraz jej potencjalne środowiskowe i zdrowotne konsekwencje. Zag. Doradztwa Rol. 1(107), 22–40 [in Polish].

Bernaciak A., Beanaciak A., Janicka M. 2021. The field of study as a factor differentiating students' level of environmental awareness. Ekon. Środ. 77(2), 144–161. https://doi.org/10.34659/ 2021/2/17

Cochoy F., Licoppe C., Petersson McIntyre M., Sörum N., 2020. Digitalizing consumer society. Equipment and devices of digital consumption. J. Cult. Econ. 13, 1–11. https://doi.org/10.1080/ 17530350.2019.1702576

Dudkowska M., 2023. Związki pochodzenia naturalnego w przeciwdziałaniu starzenia. Kosmos. Probl. Nauk Biol. 72(4), 503–516. https://doi.org/10.36921/kos.2023_2970

Fan Z., Hasing T., Johnson T.S., Garner D.M., Barbey C.R., Colquhoun T.A., Sims C.A., Resende M.F.R., Whitaker V.M., 2021. Strawberry sweetness and consumer preference are enhanced by specific volatile compounds. Hortic. Res. 8(66). https://doi.org/10.1038/s41438-021-00502-5

Fritz C.O., Morris P.E., Richler J.J., 2012. Effect size estimates: current use, calculations, and interpretation. J. Experim. Psychol. Gen. 141(1), 2–18.

Giampieri F., Alvarez-Suarez J.M., Mazzoni L., Romandini S., Bompadre S., Diamanti J., Capocasa F., Mezzetti B., Quiles J.L., Ferreiro M.S., Tulipani S., Battino M., 2013. The potential impact of strawberry on human health. Nat. Prod. Res. 27(4–5), 448–455.

Giampieri F., Forbes-Hernandez T.Y., Gasparrini M., Alvarez-Suarez J.M., Afrin S., Bompadre S., Quiles J.L., Mezzetti B., Battino M., 2015. Strawberry as a health promoter: an evidence based review. Food Function 6(5), 1386–1398.

Gondek K., Gondek K., Kopeć M., Mierzwa-Hersztek M., Jarosz R., Zaleski T., Bogdał S., Bieniasz M., Kaczmarczyk E., Knaga J., Nawrocki J., Pniak M., Kowalczyk B., Błaszczyk J., 2020. Mineral composition of fruits and leaves of San Andreas® everbearing strawberry in soilless cultivation. J. Elementol. 4. https://doi.org/10.5601/jelem.2020.25.2.2013

GUS, 2024a. Budżety gospodarstw domowych w 2023 r. [Household budget survey in 2023]. https://stat.gov.pl/obszary-tematyczne/warunki-zycia/dochody-wydatki-i-warunki-zycia-ludnosci/budzety-gospodarstw-domowych-w-2023-roku,9,22.html [access: 6.07.2024].

GUS, 2024b. Rocznik Statystyczny Rzeczypospolitej Polskiej 2024 [Statistical yearbook of the Republic of Poland 2024]. https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-rzeczypospolitej-polskiej-2024,2,24.html [access: 7.07.2024].

Ita Y., Ita A.K., Rahaju B., 2019. Strawberry extract as a tooth stain remover. Health Notions 3(1), 28–31. https://doi.org/10.33846/hn.v3i1.300

Janda K., Kasprzak M., Wolska J., 2015. Witamina C – budowa, właściwości, funkcje i występowanie [Vitamin C – structure, properties, occurrence and functions]. Pomerian J. Life Sci. 61(4), 419–425 [in Polish].

Kamińska K., 2024. Preferencje studentów w zakresie spożycia świeżych owoców. Praca inżynierska, SGGW w Warszawie, 35 [in Polish].

Khan N., Syed D., Ahmad N., Mukhtar H., 2013. Fisetin. A dietary antioxidant for health promotion. Antioxid. Redox Signal 19(2),151–162. https://doi.org/10.1089/ars.2012.4901

Kim S., Choi K.J., Cho S.J., Yun S.M., Jeon J.P., Koh Y.H., Song J., Johnson G.V.W., Jo C., 2016. Fisetin stimulates autophagic degradation of phosphorylated tau via the activation of TFEB and Nrf2 transcription factors. Int. J. Sci. Rep. 6, 24933. https://doi.org/10.1038/srep24933

Kopytowski J., Kawecki Z., Bojarska J.E., Stanys V., 2006. Ocena plonowania i jakości owoców kilku odmian truskawki uprawianej na Warmii [Yielding and fruit quality of some strawberry cultivars cultivated in the Warmia region]. Zesz. Nauk. Instyt. Sad. Kwiac. 14, 53–64.

KZGPOiW, 2023. Truskawki z rekordami konsumpcji w każdym kolejnym miesiącu lata – Kantar. https://polskiesuperowowe.pl/264813-truskawki-z-rekordami-konsumpcji-w-kazdym-kolejnym-miesiacu-lata-kantar [access: 24.02.2025].

Miller K., Feucht W., Schmid M., 2019. Bioactive compounds of strawberry and blueberry and their potential health effects based on human intervention studies: A brief overview. Nutrients 11(7), 1510.

Odriozola-Serrano I., Soliva-Fortuny R., Gimeno-Ano V., Martin-Belloso O., 2008. Kinetic study of anthocyanins, vitamin C, and antioxidant capacity in strawberry juices treated by high-intensity pulsed electric fields. J. Agri. Food Chem. 56(18), 8387.

Park H., 2021. Financial behavior among young adult consumers: the influence of self-determination and financial psychology. Young Consumers 22(4), 597–613. https://doi.org/10.1108/YC-12-2020-1263

Pinto M.S., Lajolo F.M., Genovese M.I., 2008. Bioactive compounds and quantification of total ellagic acid in strawberries (*Fragaria × ananasa* Duch.). J. Agric. Food Chem. 107, 1629–1635. https://doi.org/10.1016/j.foodchem.2007.10.038

Pukszta T., Platta A., 2017. Truskawki jako źródło składników bioaktywnych wspomagających profilaktykę chorób nowotworowych [Strawberries as the source of bioactive ingredients supporting prevention of cancers]. Bromat. Chem. Toksikol 3, 234–240.

Roalmer, 2022. Consumer report: the strawberry season. https://www.roamler.com/consumer-report-the-strawberry-season/ [access: 5.07.2024].

Roberts R.E., Eslick B., KC D., 2021. Understanding consumer preferences for new market entry: A study of strawberry consumption in Jakarta. Acta Hortic. 1309, 1053–1062. https://doi.org/10.17660/ActaHortic.2021.1309.149

Ruth T.K., Rumble J.N., 2016. Branding the berries: consumers' strawberry purchasing intent and their attitude toward Florida strawberries. J. Appl. Commun. 100(2), 26–42. https://doi.org/10.4148/1051-0834.1028

Seram N.P., 2014. Berry fruits: compositional elements, biochemical activities, and the impact of their intake on human health, performance, and disease. J. Agric. Food Chem. 62(18), 3839–3841. https://doi.org/10.1021/jf071988k

Sparacino A., Ollani S., Baima L., Oliviero M., Borra D., Rui M., Mastromonaco G., 2024. Analyzing strawberry preferences: Best–worst scaling methodology and purchase styles. Foods 13(10), 1474. https://doi.org/10.3390/foods13101474

Stea T.H., Nordheim O., Bere E., Stornes P., Eikemo T.A. 2020. Fruit and vegetable consumption in Europe according to gender, educational attainment and regional affiliation – A cross-sectional study in 21 European countries. PLoS One 15(5), e0232521. https://doi.org/10.1371/journal.pone.0232521

Wang J., Yue C., Gallardo K., McCracken V., Luby J., McFerson J., 2017. What consumers are looking for in strawberries: Implications from market segmentation analysis. Agribusiness 33, 56–69. https://doi.org/10.1002/agr.21473

Wendin K., Egan P.A., Olsson V., Forsberg S., Nilsson A., Stenberg J.A., 2019. Is there a best woodland strawberry? A consumer survey of preferred sensory properties and cultivation characteristics. Int. J. Gastronomy Food Sci. 16, 100151.

Zdrojewicz Z., Bieszczad N., Gąsior P., Rogoza A., 2017. Eating strawberries – you will be healthier. Med. Rodz. 20(1), 48–52.

Zmarlicki K., Brozowski P., 2020. Perspektywy, szanse i zagrożenia dla produkcji truskawek, jagody kamczackiej i aronii. Instytut Ogrodnictwa, Skierniewice [in Polish]. http://www.inhort.pl/files/program_wieloletni/PW_2015_2020_IO/spr_2020/5.1_Zmarlicki_Raport_2020.pdf