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Polish Consumer Preferences and Awareness about Products Containing Caffeine

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ABSTRACT

Objective: The main objective of this article was the recognition of food choices, consumption of products containing caffeine and purchasing habits regarding products containing caffeine on the Polish market. The article characterises Polish consumers' preferences toward caffeine-containing beverages (CCBs) such as coffee, tea, yerba mate and energy drinks.
Research Design & Methods: The research was conducted by means of CAWI (computer-assisted web interview) and a personal interview. A closed ended question questionnaire was used during the research, and there were 400 respondents of both genders. The Pearson chi-square test of independence was applied to assess the association between categorical variables.
Findings: The research demonstrated that CCBs, such as coffee and tea, are the most preferred sources of caffeine. Significant differences related to age and gender of respondents when it comes to preference for caffeine in coffee and tea were determined. Respondents most frequently chose beans coffee, and leaf tea in bags, which was related to the age and education or the place of residence. The majority of respondents qualified coffee, yerba mate and tea as pro-health products.

Implications/Recommendations: The indication of recommendations when it comes to the increase of consumer awareness about the influence that coffee has on the human body and its diversified amount in CCBs, which has an impact on rational consumption. Main actions in this area should be focused on providing reliable information on product labels by food producers in order to ensure food safety and customer satisfaction with the reliable identification of purchased products.

Contribution: The main source of caffeine coming from CCBs is coffee, recognised as a drink demonstrating pro-health properties, and its frequency of consumption increases with age. The research proves high awareness of consumers when it comes to CCBs properties. The problem which arises is their increasing consumption.

Article type: original article.

Keywords: products containing caffeine, quality of products, consumer study, consumer preferences.

JEL Classification: D1, D12, E21.

1. Introduction

The economies of highly industrialised countries very often use the psychoactive substance caffeine, not only to increase income, but also in the social area to activate society in its productive and post-productive age. Nevertheless, the excessive and irrational consumption of caffeine contained in caffeine-containing beverages (CCBs) has a huge impact on the quality of life and the dysfunction of ecosystems.

For these reasons, in-depth quality control of CCBs offered by the market and other measures to promote knowledge about them become justified.

The main objective of this article was the recognition of the current food choices, consumption of products containing caffeine and purchasing habits regarding products containing caffeine on the Polish market. The paper characterises Polish consumers' preferences toward CCBs such as coffee, tea, yerba mate and energy drinks.

In this article, attention is drawn to environmental (ecosystem) protection issues in the context of their yearly increasing consumption. In addition, the study addresses the safety of this type of CCBs, which is of great importance to consumers and producers.

2. Literature Review

Caffeine is a methylxanthine alkaloid occurring in nature in 60 plant species in the world (Barone & Roberts, 1984). The most popular sources of it are coffee beans (cocoa fruits), tea leaves, yerba mate, cocoa beans and kola nuts (Buerge *et al*., 2003; Frary, Johnson & Wang, 2005; Cruz *et al*., 2016). The interest in caffeine and its

most common source, namely coffee, is currently very high. Almost 50,000 articles cover this topic (as of 10 August 2021) (Abalo, 2021). This substance is classified as of the most frequently consumed psychoactive substances by people and its global consumption increases mainly due to population growth (Quadra *et al*., 2020). Most frequently consumed products containing caffeine, according to FAO data compiled by Reyes and Cornelis (2018) for 90 countries, are coffee and tea. Nevertheless, coffee is indicated as the main source of its consumption in the world, estimated at around 70% of total caffeine consumption. The cocoa tree is grown in around 80 countries and main producers are Brazil, Columbia and Vietnam. The mentioned countries produce altogether around half of the world's production.

In 2022 the consumption of coffee increased to 178.5 million sacks (60 kg each) (Fig. 1).

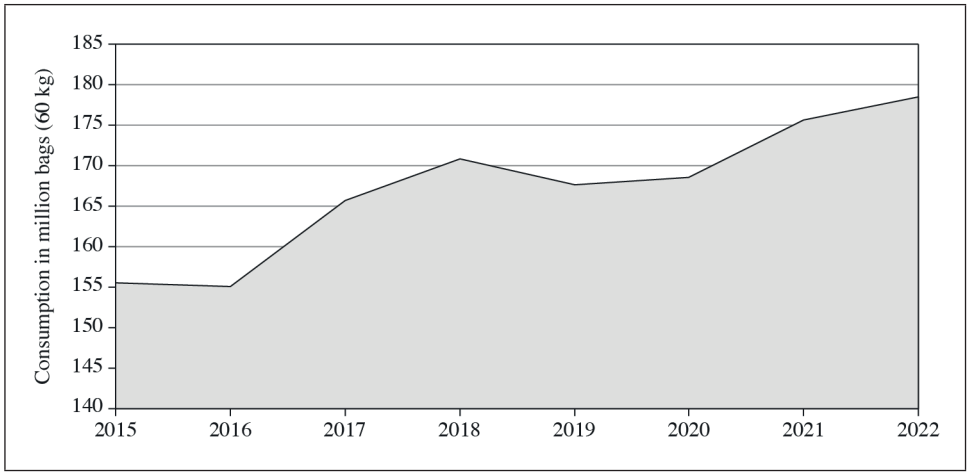

Fig. 1. Total of Coffee Consumption between 2015 and 2022

Source: own study based on International Coffee Organization (2023, 2024).

Between 2015 and 2022, the consumption increased by over 23 million sacks. In 2019 and 2020, the decrease in the consumption of coffee was observed due to the outbreak of the COVID-19 pandemic, but already in 2021 the consumption started to increase significantly (Fig. 1).

According to the current research, caffeine coming from coffee constitutes its main source of consumption among others in Brazil (Mendes *et al*., 2020) and Switzerland (Rochat *et al*., 2019). The latest data demonstrate that the consumption of coffee in Poland has been showing an upward trend and between 2010 and 2020 increased by around 80% (Surma *et al*., 2020). The upward trend of caffeine/coffee consumption per resident was also observed in Italy, Brazil and Ethiopia (Quadra *et al*., 2020). Moreover, in European countries importing coffee, there is a high

positive correlation between coffee consumption per resident and human development index (HDI) and gross domestic product (GDP). However, the opposite trend (high negative correlation) was observed in certain African countries exporting coffee (Quadra *et al*., 2020).

Several research papers confirm that the consumption of coffee is very beneficial for our health (Sanchez, 2017; Gökcen & Şanlier, 2019; Antwerpes *et al*., 2020; Herden & Weissert, 2020; Nowaczewska, Wiciński & Kaźmierczak, 2020; Abalo, 2021; Saud & Salamatullah, 2021; Ding, Xu & Lau, 2023). However, more and more often, the correlation between health benefits stemming from the consumption of coffee and the amount and frequency of its consumption is indicated (Sanchez, 2017).

A serious problem seems to be the progressive increase in caffeine consumption, which contributes to the increase of its emission into the natural environment. To some extent, the stability of caffeine in different environmental conditions and high solubility in water (13.0 g/l) foster this situation (Cruz *et al*., 2016). The human organism effectively metabolises this substance, but 0.5% to 10% is excreted in urine (Ferreira, 2005; Cruz *et al*., 2016). This is, however, not the only source of its emission into the natural environment; others include all fluid and solid waste, mainly the result of the preparation of such beverages as coffee and tea. Caffeine was discovered in water matrices all over the world; it is thus justified to relate the consumption of coffee in time to the increase of caffeine concentration in the environment (Cruz *et al*., 2016). Growing consumption of coffee leads to the fact that we deal with the continuous transmission of caffeine and other methylxanthines to the environment. The abovementioned fact may have a significant impact on the organisms present therein (Cruz *et al*., 2016). It was proven that in concentrations significant for the environment, caffeine influences the increase of oxidative stress in mussels (Almeida *et al*., 2015; Álvarez-Muñoz *et al*., 2015). The World Health Organization acknowledged the fact that the increase in caffeine concentration in the environment constitutes a real problem requiring immediate measures, such as research on potential sources of emission and environmental controls (Montagner *et al*., 2014; Quadra *et al*., 2020).

Coffee consumption rates are correlated with the rate of social development and gross domestic product. It is, thus, a very important ingredient of products, the consumption of which determines the level of socio-economic development. The increase in caffeine consumption enhances its influence on the environment and contributes to its excessive accumulation in ecosystems. More and more often, its negative effects on certain aquatic organisms are indicated as a factor generating oxidative stress. The discovery of caffeine in different aquatic environments led to the suggestion that caffeine may be the so-called indicator of anthropogenic pollution (Cruz *et al*., 2016).

Poland is listed among countries exhibiting average consumption of coffee in the range between 2.13 and 3.95 kg per person per year (an average of 1 to 2 cups

of coffee daily or 5 grams of ground coffee beans per 200 ml cup). The biggest consumers of coffee are Germans, Norwegians, Swedes, Finns and Danes who consume between 7.36 and 21.54 kg per person per year (Quadra *et al*., 2020).

High ratio of coffee consumption amounting to 3.95–7.36 kg per person per year was observed also in Brazil, the USA and countries of Southern Europe.

This article also covers essential social and economic issues connected with the dynamic increase in the consumption of caffeine on the basis of a literature overview, but also our own study (surveys). The issues discussed in the article cover both the topic related to caffeine consumption concerning mostly shaping consumers' attitudes toward the most frequently consumed products containing caffeine (CCBs) but also pro-health aspects referring to the consumption of the mentioned sources of food. The presented research also covers current issues connected with the safety of food containing caffeine and the impact that particular alkaloid has on the natural environment and market. The consumption volume of such products as coffee and tea was considered a key indicator of caffeine consumption, which is in accordance with the frequency and scale of their consumption (Reyes & Cornelis, 2018).

The questionnaire survey presented in the article was conducted between September 2023 and November 2023 on a balanced representative sample of 400 respondents, constituting 50% females and 50% males across all age ranges.

Bioactivity and Pro-health Influence of Caffeine

Nowadays, people use numerous active substances occurring in nature, which may influence their longevity and which demonstrate many pro-health functions. One of them is caffeine stemming from many plant sources (Barone & Roberts, 1984).

This alkaloid, due to its ability to stimulate the central nervous system, is commonly used in formulas of many medications all over the world (Mustard, 2014; Cappelletti *et al*., 2015). There are multiple reports confirming the beneficial influence of coffee and caffeine on the human body.

Recent research has demonstrated that beneficial biological functions of coffee consumption include, among others, lowering of sugar level in blood, protection of liver and nerves, mainly by such constituents as alkaloids, phenolic acids, flavonoids and terpenoids (Gökcen & Şanlier, 2019).

Recent research has also proved that coffee extracts and their active constituents counteract the development of cancers (including colon cancer, leukaemia and breast cancer), cataract and glaucoma and also certain brain diseases, pathogenic infections, hepatic fibrosis (Saud & Salamatullah, 2021) and support the treatment of arthritis (Ding, Xu & Lau, 2023).

For people suffering from migraines, it was proven that maintaining a constant daily intake of caffeine not exceeding 200 g (Nowaczewska, Wiciński & Kaźmierczak, 2020) helps them to avoid the headache caused by withdrawal

effects. Research by Hong, Chan and Bai (2020) demonstrated that caffeine lowers the risks and progression of Parkinson's disease. The increased consumption of coffee may have neuroprotective effects in case of hepatitis C, which was proved by Antwerpes *et al*. (2020). Neuroprotective effects of caffeine are particularly complex and related to gender and age (Jee *et al*., 2020). Caffeine improves reaction time in memory tasks (Zhang & Madan, 2021), what is more the caffeine source may significantly change the memorisation processes. It was also observed that the reaction time to caffeine is related to gender and age (Nowaczewska, Wiciński & Kaźmierczak, 2020).

Quality Characteristics of Beverages Containing Caffeine and Coffee Consumption

The most common food sources of caffeine are beverages, namely coffee, tea, alcoholic and non-alcoholic beverages, energy drinks (Zucconi *et al*., 2013), food products such as chocolate, cacao or guarana, supplements, but also medications (Abalo, 2021). Caffeine isolated from plants is also used as an additive to food and cosmetic products (Balawejder-Biśto & Pyka-Pająk, 2022). In natural products containing caffeine, there are many ingredients which may be both favourable for our health (polyphenols, diterpenes, chlorogenic acids, melanoids, microelements, fibre) but also unfavourable, such as for instance acrylamide and furans resulting from coffee beans roasting (Abalo, 2021; Strocchi *et al*., 2022). The reason for the occurrence of undesired compounds such as acrylamide or furans is the roasting (Schouten, Tappi & Romani, 2020). Maximum permitted levels of acrylamide (μg/g) in food were provided in EU regulation UE 2017/2158. For coffee they are respectively 400 μg/kg in case of roasted coffee and 850 μg/kg for instant coffee (EUR-Lex, 2023).

The dominant source of caffeine in people's diet is the so-called beverages containing caffeine (CCBs), which are characterised by unique nutritional values (McLellan & Lieberman, 2012; Mitchell *et al*., 2015). CCBs are rich in various compounds which are beneficial but at the same time may pose a danger to human life. It is thus extremely important to take into consideration the source of caffeine consumption (McLellan & Lieberman, 2012; Mitchell *et al*., 2015; Da Silveira *et al*., 2017). Among CCBs coffee comes first, taking into account the amount consumed, then comes tea, the consumption of which is significantly lower (Reyes & Cornelis, 2018). Consumption habits are mostly influenced by such factors as geographical origin, culture, lifestyle, social behaviours and economic status (Reyes & Cornelis, 2018). Methods of coffee brewing differ in particular regions of the world, and this is the basic factor determining the amount of caffeine in a given beverage (Reyes & Cornelis, 2018; *Caffeine in Coffee*, 2023). Drip filter coffee belongs to the most popular methods of coffee brewing all over the world, whereas coffee from

automated coffee pressure machines is dominant in Southern Europe. Turkish-style coffee is popular in the Middle East, in Greece, Turkey and Eastern Europe, whereas espresso and moka are the most popular in Italy, Spain and Portugal (Lopez-Garcia *et al*., 2014; Sousa & da Costa, 2015; Bagdas *et al*., 2020).

Beverages such as coffee and tea belong to the most frequently consumed products containing caffeine (Fig. 2). In Poland, an average consumer consumes from 1 to 2 cups of coffee daily (5 grams of ground coffee beans per 200 ml cup), which, when converted into coffee beans, gives an annual consumption at the level of 3.65 kg/year.

On average, coffee beans include around 1–3% caffeine, however during the preparation of the brew around 75% to 100% of caffeine from beans is preserved in them (Wierzejska, 2012). A cup of ground coffee (volume 160 ml) may contain around 100 mg caffeine (O'Keefe, DiNicolantonio & Lavie, 2018). Coffee prepared Turkish-style and espresso contain the highest amounts of caffeine, while low-caffeine coffees include, among others, manual drip and infusion bag coffee (40–60 mg/100 ml). Because of the abovementioned and other reasons, it is difficult to estimate the unit's daily consumption level. Nevertheless, the emission of caffeine coming from coffee consumption to the environment is the biggest among all CCBs (Cruz *et al*., 2016).

3. Materials and Methods

This research concerns consumer preferences as far as products containing caffeine are concerned, namely CCBs, such as coffee, tea, yerba mate and energy drinks. The assessment of these beverages was conducted in the areas of acceptance for these caffeine sources, frequency of their intake, distinguishing features determining their quality and pro-health properties.

The research was conducted by means of computer assisted online interviews (computer-assisted web interview – CAWI) and a personal interview, from September and November 2023 among Polish consumers. A closed-ended question questionnaire was used during the research, and there were 400 respondents of both genders at the age of 18 and over, 200 females and 200 males respectively (Table 1). The most important criteria for the selection of the research sample were the declaration of consumption of products containing caffeine and the age of the respondents (100 people in each age group). A representative sample was selected in a balanced way, as it was assumed that gender and age affect the choice of products containing caffeine. Therefore, in the present article, the sample consisted of the same percentage of consumers from each age group.

Literature data demonstrate that sociodemographic factors are essential when it comes to the selection of products containing caffeine (Reyes & Cornelis, 2018).

Table 1. Sociodemographic Characteristics of the Study Population (n = 400)

Category	Data	Percentage of Respondents
Gender	Female	49.75
	Male	50.25
Age	18–20	25
	21–30	25
	31–40	25
	41 and above	25
Education	Primary	3.75
	Secondary	47.25
	High	40.50
	Vocational	8.50
Place of residence	Rural area	27.50
	City with up to 20,000 residents	14.00
	City with over 20,000 and below 100,000 residents	12.50
	City with over 100,000 and below 500,000 residents	14.25
	City with over 500,000 residents	31.75

Source: own study.

Each questionnaire response was assigned four distinguishing features describing a given respondent, namely gender, age, education and place of residence. The Pearson chi-square test of independence (at the significance level of $\alpha = 0.05$) was performed using the Statistica software package to assess the association between nominal variables.

4. Results and Discussion

4.1. Caffeine Consumption among Respondents

Conducted research indicates significant differences when it comes to the preference for caffeine coming from such products as coffee, tea, yerba mate, energy drinks, which are related to respondents' age and gender (chi-square test, p-value < α, assumed level of significance $\alpha = 0.05$) (Table 2). The research also demonstrates that among four different types of CCBs (tea, coffee, energy drinks and yerba mate), the majority of respondents (68%) prefer coffee. Among that respondent group, there were 52% females and 48% males. The second preferred source of caffeine, according to the respondents (21%), was tea, in similar proportions, 51% females and 49% males.

Table 2. Percentage of Respondents' Answers Regarding the Most Frequently Selected Caffeinated Products and Their Assortment (Pearson Chi-square Independence Test, Significant Differences at the Significance Level $\alpha \leq 0.05$)

Question	Criterium		Answer (%)				Total %	*p*-value
			Tea	Coffee	Energy drinks	Yerba mate		
Which of the following sources of caffeine do you prefer most?	Gender	Female	22.11	71.36	4.52	2.01	100	0.00032
		Male	20.90	65.17	1.49	12.44	100	
	Age	18–20	29.0	57.0	5.00	9.00	100	0.00073
		21–30	16.0	64.0	6.00	14.0	100	
		31–40	22.0	74.0	1.00	3.00	100	
		41 and above	19.0	78.0	0.00	3.00	100	
Question	Criterium		Answer (%)					*p*-value
			Bean coffee	Ground coffee	Instant coffee	I don't drink coffee	Chicory coffee	
Which coffee type do you prefer the most?	Age	18–20	29.0	21.0	32.0	16.0	2.0	0.0000
		21–30	50.0	16.0	14.0	15.0	5.0	
		31–40	56.0	27.0	9.0	6.0	2.0	
		41 and above	50.0	25.0	23.0	0.0	2.0	
	Education	Higher	58.02	19.14	11.73	7.41	3.70	0.00026
		Secondary	39.68	21.16	25.40	11.64	2.12	
		Vocational	41.18	41.18	11.76	2.94	2.94	
		Primary	13.33	26.67	46.67	13.33	0.0	

Table 2 cnt'd

Question	Criterium		Answer (%)					*p*-value
			Express tea	Leaf tea – loose	Leaf tea – in bags	I don't drink tea	Instant tea	
Which tea type do you prefer the most?	Age	18–20	15.0	24.0	49.0	2.00	10.0	0.00651
		21–30	14.0	40.0	39.0	6.00	1.00	
		31–40	21.0	34.0	39.0	4.00	2.00	
		41 and above	22.0	33.0	42.0	0.0	3.00	
	Education	Higher	15.43	39.51	38.89	4.32	1.85	0.00881
		Secondary	18.52	30.69	43.39	2.12	5.29	
		Vocational	32.35	26.47	38.24	0.0	2.94	
		Primary	6.67	0.0	73.33	6.67	13.33	
	Place of residence	Rural area	24.55	29.09	40.0	1.82	4.55	0.03217
		City with up to 20,000 residents	32.14	26.79	33.93	0.00	7.14	
		City with over 20,000 and below 100,000 residents	10.0	36.0	44.0	4.00	6.00	
		City with over 100,000 and below 500,000 residents	14.04	42.11	36.84	3.51	3.51	
		City with over 500,000 residents	11.02	33.07	49.61	4.72	1.57	

Notes: $p \leq \alpha$ – null hypothesis (H_0) is rejected in favour of alternative hypothesis (H_A), $\alpha = 0.05$ (it means that there is a statistically significant association between the variables under study).

Source: own study.

The declaration of the youngest respondents, namely people between the ages of 18 and 20, constituted 21% as far as coffee preference is concerned, and people at the age of 41 and over constituted 29%.

The research also demonstrates that the choice of coffee by consumers in favour of other beverages increases with age of respondents ($p < \alpha$, the assumed level of significance $\alpha = 0.05$). Respondents, regardless of gender, consume more coffee with age, declaring its consumption even a few times a day (Fig. 2).

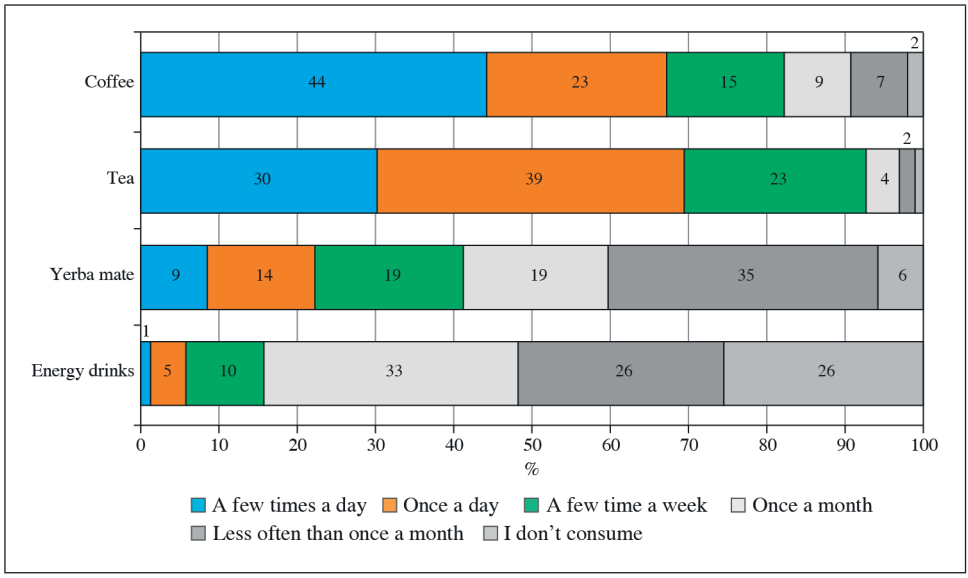

Fig. 2. The Frequency of CCBs Consumption by Respondents
Source: own study.

Most frequently, the respondents declared that they consume coffee a few times a day (over 44% of respondents) – see Figure 2. Those were mainly people from two age ranges: 31–40 and 41 and older. The frequency of coffee consumption depends on the gender or age ($p < \alpha$) (Table 3). In the case of tea, respondents most frequently (39%) declared that they consume it once a day, then (30% of respondents) a few times a day (Fig. 2). Interestingly enough, the highest percentage (36%) of tea consumption a few times a day was observed among respondents at the age 20 and under, which was connected not only with age but also with gender. The percentage of females consuming tea a few times a day amounted to 60%, and in the case of males, 39%.

The research indicates that beverages such as yerba mate are not as popular among consumers as tea or coffee because only 9% of respondents confirmed its consumption a few times a day, and a slightly higher percentage of respondents (14%)

declared that they consume the abovementioned beverages once a day. The highest percentage of respondents declared that they consume yerba mate less frequently than once a month (35% of respondents, Fig. 2), and those were mainly females (65%) under 20 (30%), most frequently from cities having more than 500,000 residents (40%) or rural areas (26%). Respondents aged 31–40 and 41 years and older declared that they consume yerba mate a few times a week and their percentage amounted to 68%. Respondents from this age group declared mainly secondary education (55%) or higher education (34%). Sociodemographic factors significantly influence the frequency of yerba mate consumption (Table 3).

Table 3. The Influence of Sociodemographic Factors on the Frequency of Consumption of Caffeinated Products (Pearson Chi-square Independence Test, Significant Differences at the Significance Level $\alpha \leq 0.05$)

Question: Please Provide the Frequency of Consumption	Answer	Criterium	*p*-value
Coffee	– a few times a day – once a day – a few times a week – once a month – less often than once a month – I don't consume / question	Age	0.0000
		Gender	0.00253
Tea		Age	0.01472
		Gender	0.00001
Yerba mate		Age	0.02693
		Education	0.02445
		Place of residence	0.02849
Energy drinks		Age	0.00000
		Education	0.00262
		Place of residence	0.00204

Notes: $p \leq \alpha$ – null hypothesis (H_0) is rejected in favour of alternative hypothesis (H_A), $\alpha = 0.05$ (it means that there is a statistically significant association between the variables under study).

Source: own study.

In the case of energy drinks, the majority of respondents (60%) declared that they consume these beverages once a month or even less frequently. These respondents were aged between 18 and 30, had secondary education (52%) or higher education (38%), and resided in rural areas or cities with more than 500,000 inhabitants. The frequency of energy drinks consumption depended on the age, education and place of residence (Table 3).

4.2. Consumption Habits When It Comes to the Choice of Products Containing Caffeine

Coffee beans contain around 1–3% of caffeine, however, depending on the preparation method, from 75% to even 100% of caffeine coming from beans remain in them (Wierzejska, 2012). Therefore, literature data confirm that the way the coffee extract is prepared constitutes a key factor determining the caffeine consumption (Da Silveira *et al*., 2017).

The results of the conducted research demonstrate that respondents most often choose bean coffee (46%), then ground coffee (22%) and finally instant coffee (20%). Respondents having a preference for bean coffee most frequently declared higher education (51%), ground coffee or instant coffee – secondary education (respectively 45% and 62%). It was also stated that the consumption of different coffee types (ground, instant or bean) is significantly connected with age and education of respondents (chi-square test, value $p < \alpha$, at the assumed significance level $\alpha = 0.05$, Table 2). The consumers of instant coffee are mainly people under 20 with secondary education, and respondents from other age ranges prefer bean coffee.

People declaring higher education most frequently selected bean coffee (58%), then ground coffee (19%) or instant coffee (11%) (Table 2). Likewise, respondents with secondary education most frequently selected bean coffee (39%), then instant coffee (25%) or ground coffee (21%). By contrast, people with vocational education to the same extent preferred bean coffee (41%) and ground coffee (41%) and less frequently instant coffee (12%) (Table 2). The selection of coffee types by consumers is not connected with gender ($p \geq \alpha$, assumed level $\alpha = 0.05$). Females and males consume almost equally bean, ground or instant coffee.

Young people under 20 most frequently chose instant coffee, followed by bean coffee, and finally ground coffee. Respondents in the remaining age ranges chose bean coffee. In these age groups, the percentage of people preferring bean coffee amounted to 50% (56% in the 31–40 age group, see Table 2).

Among different tea types, respondents most frequently preferred leaf tea in bags, followed by leaf tea sold loose, and finally express tea (Table 2). This choice to a great extent depends on the age, educational background and place of residence. Young people, under 20 years, most frequently chose leaf tea in bags (49%), then the one sold loose (24%) and finally express tea (15%). Respondents aged 21–30 selected leaf tea sold loose (40%) or in bags (39%), then express tea (14%). In the age range of 31–40 years, slightly more people declared the choice of leaf tea in bags (39%) than the one sold loose (34%) or express tea (21%). In the age group of 41 years and over most frequently the respondents selected leaf tea in bags (42%) and sold loose (33%). The majority of respondents declared the choice of leaf tea in bags, among which the people with higher education constituted 39%, with secondary education 43%, with vocational education 38% and with primary education 73% (Table 2).

At the same time, leaf tea sold loose was chosen in second place, and the highest percentage of respondents were those with higher education (39%), then secondary education (30%), while 26% had vocational education.

Respondents who mostly preferred leaf tea lived in big cities having over 500,000 residents (on average 34% of people) or rural areas (on average 24% of people).

4.3. Awareness of Consumers When It Comes to Pro-health Characteristics of the Products under Study

The research demonstrates that the majority of respondents, namely 58%, indicated properly that coffee has pro-health properties. A high percentage of respondents (42%) were not sure about coffee possessing pro-health properties, rather indicating that coffee has no pro-health properties. Gender, age and education in this case did not constitute a significant criterium of the consumers' knowledge about pro-health properties of coffee ($p \geq \alpha$, assumed level $\alpha = 0.05$).

In the case of consumers' awareness as to the pro-health properties of tea and yerba mate, the majority of them (respectively 80% and 62%) confirmed the beneficial influence of these products on our health, the others were not sure about it. Gender, education or place of residence did not influence the consumers' knowledge when it comes to pro-health properties of tea ($p \geq \alpha$, assumed level $\alpha = 0.05$). The only factor determining the correctness of answers given was the age (Table 4). Most frequently, young people under 20 answered correctly, indicating the pro-health properties of tea. In this age group, there were the fewest wrong answers that tea does not have such properties (12%). From the answers given by the respondents, it follows that energy drinks do not have a good reputation among consumers, since 98% of respondents acknowledged that these beverages are not healthy.

In this work, the assessment of consumers' knowledge about the influence of caffeine on our health was also conducted. Numerous literature reports cover, among others, the subject of lowering the risk of Alzheimer's and Parkinson's diseases occurrence (Hong, Chan & Bai, 2020; Nowaczewska, Wiciński & Kaźmierczak, 2020). Own study shows that fewer than 40% of respondents knew that caffeine lowers the risk of Alzheimer's and Parkinson's diseases while the majority of respondents (60.5%) had no such knowledge and indicated the wrong answer (Fig. 3). The knowledge of respondents in this regard depends on the age and education ($p < \alpha$, assumed level $\alpha = 0.05$, Table 4). The majority of people between the age 18 and 30 (59.5%) did not know the correct answer. Those were mainly people with secondary education (30%) or higher education (23%). The correct answer was marked by respondents at the age over 31 (64%). Among the respondents knowing the correct answer (fewer than 40%), the majority declared higher education (17.5%) or secondary education (17%).

Table 4. The Influence of Sociodemographic Factors on Consumer Awareness of Health-promoting Properties of Products (Pearson Chi-square Independence Test, Significant Differences at the Significance Level $\alpha \leq 0.05$)

Question	Answer	Criterium	*p*-value
Please indicate the scale of the pro-healthy value of coffee	1 – the healthiest 2 – healthy 3 – less healthy 4 – least healthy	Place of residence	0.01999
Please indicate the scale of the pro-healthy value of tea		Age	0.00079
Please indicate the scale of the pro-healthy value of yerba mate		Age	0.00236
		Place of residence	0.04548
Caffeine lowers the risk of Alzheimer's and Parkinson's diseases occurrence	– true – false	Age	0.00003
		Education	0.00586
Caffeine increases concentration and lowers the feeling of fatigue		Gender	0.02302
		Age	0.01720
Substance physiologically neutral for the human body		Age	0.00054
		Education	0.00939

Notes: $p \leq \alpha$ – null hypothesis (H_0) is rejected in favour of alternative hypothesis (H_A), $\alpha = 0.05$ (it means that there is a statistically significant association between the variables under study).

Source: own study.

The next question about the influence of caffeine on the human nervous system referred to the influence of caffeine on the increase in concentration and the decrease in the feeling of fatigue. The research demonstrated that 76% of respondents knew about the psychostimulatory activity of caffeine (Fig. 3), and their knowledge depended on gender and age ($p < \alpha$, assumed level $\alpha = 0.05$, Table 4). In this group, male respondents dominated (40%), followed by female respondents (35%). Basically, in each age range the similar percentage of respondents knowing the correct answer, between 16% and 20%, was observed. Incorrect answers were given by 24% people, including mainly female respondents (14%), and the biggest percentage of people not knowing the correct answers was visible among young people under 20 (9%), whereas the smallest was among people over 41.

The majority of respondents are aware of the influence caffeine has on the nervous system. It is confirmed by the correctness of answers given by respondents (72%) concerning the question whether the cessation of regular consumption may lead to the withdrawal effect manifested by headache, fatigue, irritation or muscle pain (Fig. 3). The knowledge of respondents in this regard did not depend on socio-demographic factors ($p \geq \alpha$, assumed level $\alpha = 0.05$).

Respondents are familiar with the effects caffeine has on the human body, indicating that caffeine does not lower blood pressure (94% of correct answers) but it

increases concentration and lowers the feeling of fatigue (76% of correct answers) (Fig. 3).

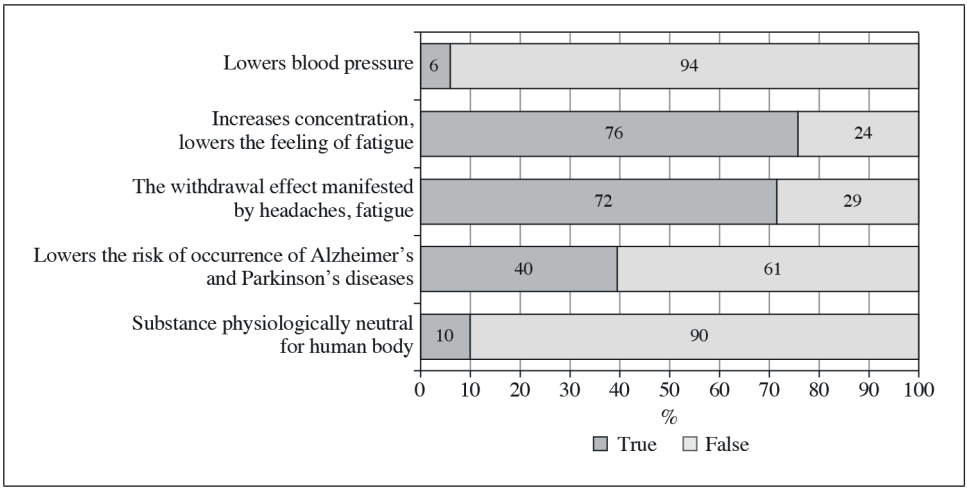

Fig. 3. The Knowledge of Respondents about the Influence of Caffeine on Health
Source: own study.

The study also analysed the factors determining the choice of CCBs. Main factors influencing the choice of products containing caffeine were taste and smell values, along with the brand and price (Fig. 4).

The third factor which can be listed is the content of caffeine in CCBs. Respondents also indicated the packaging type and pro-health properties of products containing caffeine. (Fig. 4). The research also demonstrates that advertisement and consumer references do not significantly influence their choice of products containing caffeine.

5. Conclusions

Literature data proved that caffeine consumption mostly from such sources as CCBs has an upward trend (McLellan & Lieberman, 2012). Coffee and tea are the products which have the biggest share in caffeine consumption all over the world, with the significant advantage of coffee over tea (Reyes & Cornelis, 2018).

Presented study confirmed that CCBs, such as coffee and tea, are the most frequently selected caffeine sources, whereby coffee is mostly preferred, which is confirmed by 70% of respondents. It also shows that there are significant differences in preferences for caffeine coming from coffee, tea, yerba mate or energy drinks, as well as significant associations between these preferences and respondents' age and gender.

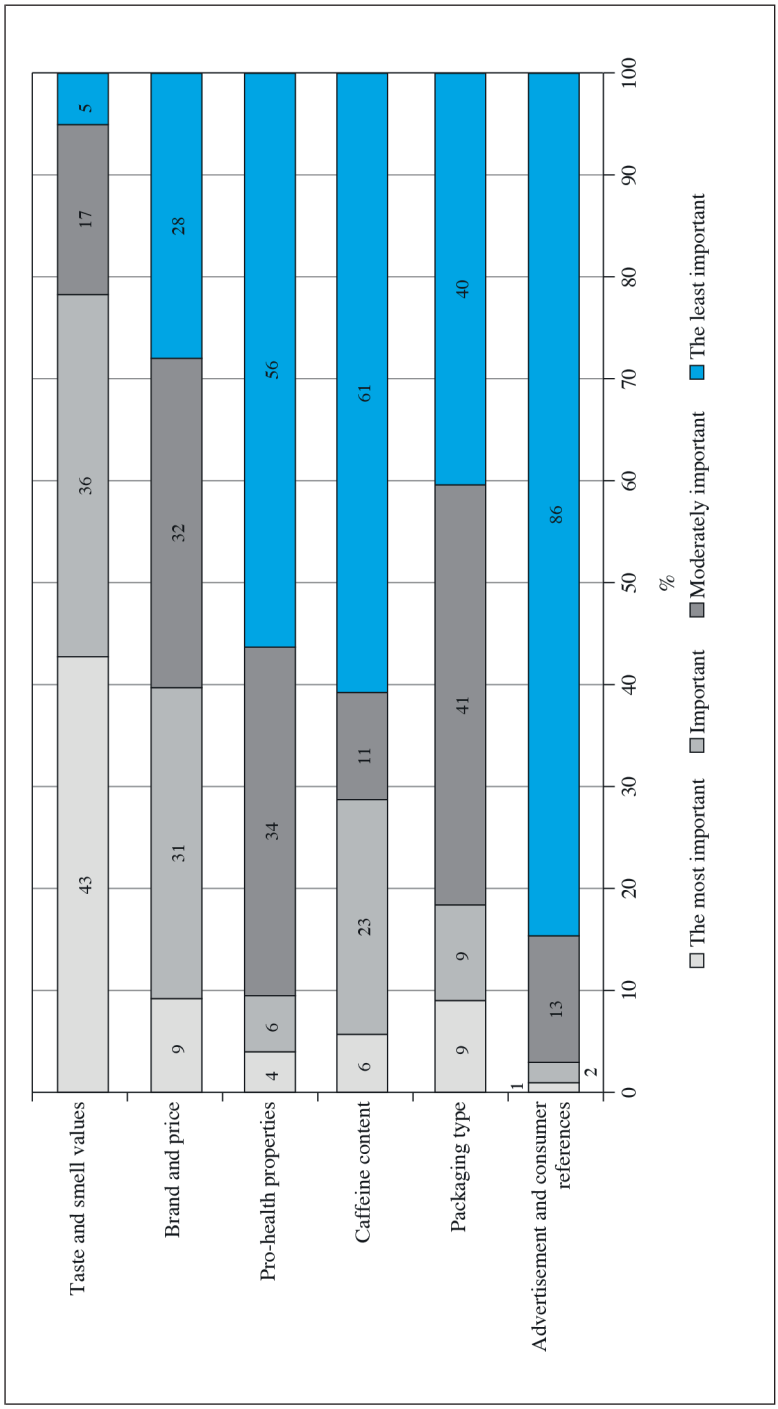

Fig. 4. Main Factors Influencing the Choice of Products Containing Caffeine
Source: own study.

Consumer preferences when it comes to coffee vary with age of respondents and demonstrate an upward trend from 57% for the youngest group of respondents to 78% for respondents aged 41 and over.

The consumption of tested coffee types (ground, instant and bean) is significantly related to the age and education of respondents. The most frequently preferred type is bean coffee, the consumption of which was declared mainly by respondents with higher education, whereas the consumption of ground and instant coffee was declared by respondents with secondary education. The consumers of instant coffee are mainly young people under 20 years old, while in other age groups most frequently selected type is bean coffee.

The frequency of CCBs consumption in particular age groups, which demonstrates an upward trend with the age of respondents, whereas for the remaining beverages under study a downward trend with increasing age, regardless of respondents' gender, is very interesting. Respondents, along with increasing age, consume more coffee, declaring its consumption a few times a day. Consumers declared that they consume coffee most frequently once a day.

By contrast, the frequency of consumption of less popular CCBs, such as yerba mate and energy drinks, is generally dependant on the majority of analysed socio-demographic factors.

In the case of pro-health properties of CCBs, the respondents despite declaring the most frequent consumption of coffee, recognised tea as the healthiest, followed by yerba mate and, finally, coffee. Energy drinks were recognised as lacking pro-health properties. The issues concerning pro-health properties of caffeine, such as its psychostimulants and negative effects of consumption cessation, called withdrawal effect, are well known to the respondents, whereas its preventive properties against Alzheimer's and Parkinson's diseases are known to only 40% of respondents.

In purchasing decisions related to CCBs, consumers value the organoleptic qualities (taste and smell) of these products most highly, but the brand and price also seem to be crucial.

The study provides the following recommendations for both consumers and manufacturers:

– Due to the increasing consumption of coffee, preference for high-waste bean and ground coffees and the associated increase in caffeine emissions to the environment, an increase in market share and marketing activities popularising low-caffeine and low-waste coffees and the inclusion of information when it comes to caffeine content on labels is required.

– It may be convenient for consumers to include information on the health-promoting properties of CCBs and their environmental impact, which could make it easier for buyers to decide whether to purchase the product. The consumer

decision-making process related to the purchase and consumption of food involves a search for information by the consumer. The point that should guide the retailer should be the content and the reliability of the information, as well as the user-friendly way in which it is communicated on the product labels.

– Information on the effects of caffeine on the human body should be taken into account when creating coffee package labels, promotional materials and advertisements. The content provided must be understandable to the potential recipient. This is all the more important as the majority of respondents declare low relevance of caffeine content in the choice of products containing it and have insufficient knowledge when it comes to its pro-health and negative effects.

– Consumers should rationalise their coffee consumption (other sources of CCBs as well) by limiting the consumption of highly caffeinated coffees, i.e., espresso or Turkish-brewed, and use decaffeinated and low-caffeinated coffee varieties for frequent consumption.

– The common point, however, should be the content and reliability of the information, as well as the accessible way of conveying it. With regard to the composition and content of information materials, the assumptions underlying the labels can be implemented.

Authors' Contribution

The authors' individual contribution is as follows: Katarzyna Mikołajczyk-Bator: conceptualisation, methodology, investigation statistical analysis, data curation, writing – original draft preparation, reviewing and editing. Dariusz Kikut-Ligaj: conceptualisation, methodology, investigation questionnaire, data curation, writing – original draft preparation.

Conflict of Interest

The authors declare no conflict of interest.

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