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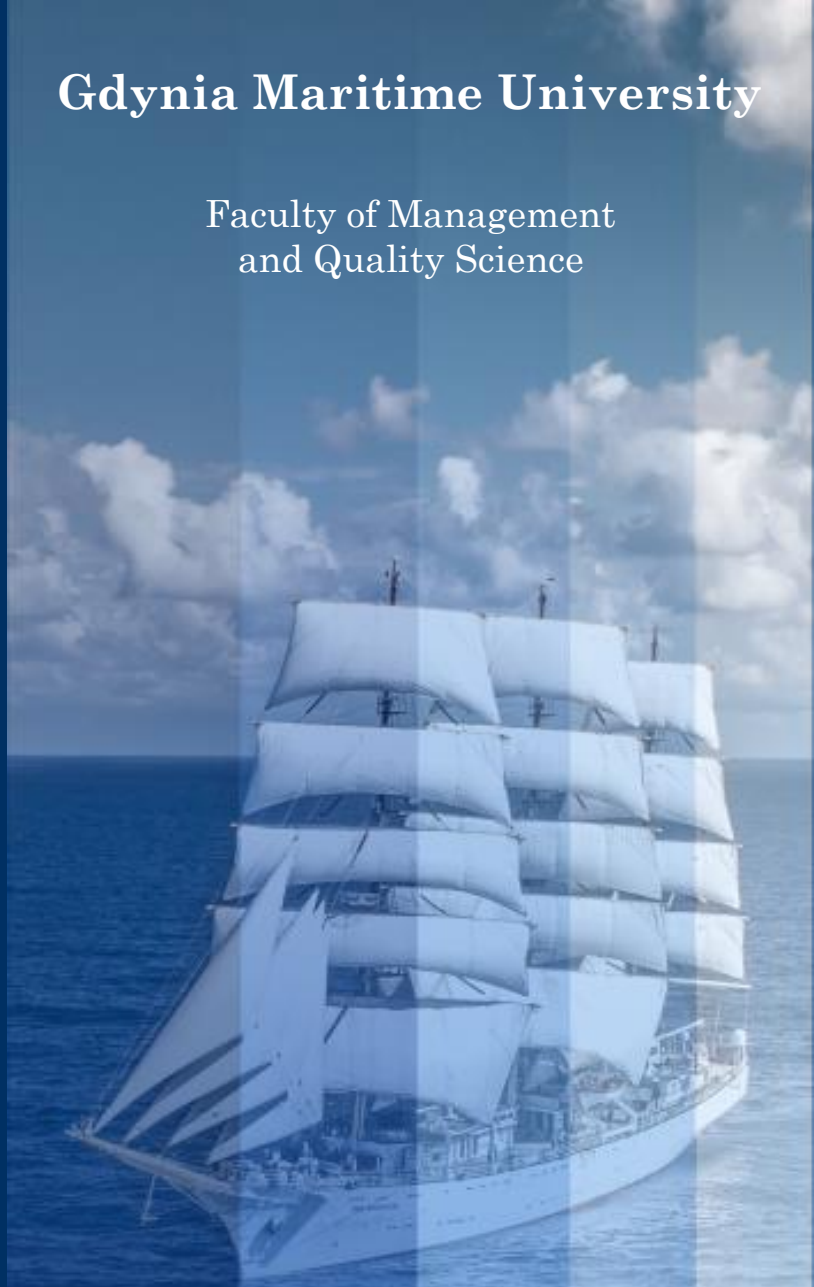

Consumer Attitudes, Preferences, and Behaviors in the Market

Postawy, preferencje i zachowania konsumentów na rynku

Edited by Anna Platta, Natalia Żak

Gdynia 2025

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THE ROLE OF PRODUCT INNOVATION IN INFLUENCING CONSUMER PURCHASING DECISIONS: THE CASE OF CONVENIENCE FOODS

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Abstract

Understanding consumer behavior in the food market is essential to promoting the conscious choice of innovative food products. The dynamic evolution of consumer preferences, emerging trends, and escalating competition imposes considerable pressures on food producers. Faced with a vast array of similar products, consumers are exhibiting increased discernment, thereby necessitating that companies differentiate themselves through the introduction of innovative products in this swiftly advancing market. The launch of new products is intimately linked to consumer attitudes, wherein the ease and rapidity of meal preparation, sophisticated taste profiles, and favorable health benefits serve as pivotal determinants. Entrepreneurs endeavor to present innovative products tailored not only to fulfill 'traditional universal needs', but also to meet individual expectations pertaining to preparation technology, recipes, quality, packaging, and cost-effectiveness. Recognized consumer needs have contributed to the development of food processing, distribution, and retail services. The starting point for analyzing a model of consumer behavior depicting the pattern of behavior in the market in question is learning about the need to purchase convenience foods. The decision to purchase a new product from the convenience food category is influenced by biological factors, economic factors, demographic factors, and geographic and natural factors. Satisfying the buyer's needs begins with seeking information about new food products. Consumers draw information from sources they consider reliable, such as market communication, the opinions of family and friends, product tastings at points

of sale, and innovative sources resulting from their own initiative and desire to learn, such as the internet and foreign travel. The choice of information source depends on the consumer's knowledge and experience. A very important factor influencing the purchase of a product is the consumer's attitude towards product innovation. Those who accept change are more likely to purchase new products in this category. The final phase of the purchase process in the convenience food market is consumers' post-purchase behavior. The results of the study showed that the evaluation of products in this sector depends on economic factors (price) and attributes of convenience foods, such as ease of preparation and short preparation time. Based on the results of the study, it can be concluded that the main factors influencing changes in consumer behavior in response to a new product in the convenience food category are the following:

- Internal factors: demographic, sociocultural, geographic, and natural factors.
- Past eating habits (conservatism and traditionalism).
- Knowledge of convenience foods and their main characteristics.
- Information and belief in the advantages of products in this category.

Keywords: consumer behavior, convenience food, innovative products.

INTRODUCTION

The development of new products in the food market is the result of globalization processes and changes in society, culture, economy, and technology. Dynamic changes in consumer needs, emerging trends, and increasing competition place significant demands on food producers. With a wide range of similar products to choose from, buyers are becoming increasingly demanding, so introducing innovative products is the main way companies can stand out in this rapidly developing market. The introduction of new products is closely related to consumer attitudes. Ultimately, consumers' purchasing behavior boils down to the acquisition, use and disposal of goods or services. This behavior is manifested through an individual's perception of their needs and is largely influenced by environmental stimuli. Changes in society, the economy, demographics, and infrastructure have increased the importance of consumers' roles in the market and, consequently, their activity [Rudnicki 2001]. Consumer behavior encompasses the rational, emotional, conscious, and unconscious reactions of consumers before, during and after

selecting, purchasing, using, or rejecting products to fulfil their needs and desires [Solomon 2006]. Consumer behavior is shaped by a range of factors, both internal and external, including [Shaw 2024]:

- Situational Factors: Contextual elements that affect decision-making, such as time constraints or environmental conditions.
- Psychological Factors: Internal influences like perception, motivation, and attitudes that impact how consumers interpret and react to information.
- Environmental Factors: External conditions such as social norms, cultural influences, and economic environment.
- Marketing Factors: Promotional activities, product features, and pricing strategies.
- Personal Factors: Individual characteristics including age, occupation, and lifestyle.
- Family and Cultural Influences: The impact of family dynamics and cultural background on purchasing decisions.

Consumers decide on the form of consumption, the type and sequence of needs that are satisfied, how these needs are met, and the extent of the costs incurred and the structure of expenditure. Consumer behavior is also divided into intentional and unintentional. Intentional behaviors are undertaken in a conscious, purposeful manner to express a particular consumer's needs. Unintentional behaviors are all those actions undertaken on impulse and not necessarily intentionally or consciously [Kos-Łabędowicz 2015]. Decision-making is a complex process that depends on the type of need being satisfied, the nature of the consumer, how important the object of consumption is, the price, and external factors that influence the consumer's decision [Olejniczak 2009].

Although consumer behavior is unpredictable, the actions of individual buyers can be identified, and patterns can be established [Bywalec 2007]. The factors that influence buyer behavior can be divided into two categories: internal and external. In the food market, social, economic, marketing, and psychological factors are especially significant [Szwacka 2007].

Table 1. Factors influencing individual food choice in the food market

Five main factors in three categories		Sub-factors under five main factors
Food-related features	Food-internal factor	Sensory features (flavor, taste, smell, and texture) and perceptual features (color, portion size, nutrition and health value, and quality)
	Food-external factor	Information (nutritional labels, health claims, packaging, aesthetics, and ethics of production history, brand, advertisement)
		Social environment (intrapersonal factor and social norms from family, peers, and media including ethical concern, social context when food choice is made)
		Physical environment (availability and accessibility of food products, food retail environments, time)
Individual differences	Personal-state factor	Biological features (genetic factors, personal dietary patterns and metabolism, physical condition such as health)
		Physiological needs (hunger, appetite, and weight status)
		Psychological components (emotion, motivation, personality)
		Habits and experiences
	Cognitive factor	Knowledge and skills
		Attitude, liking and preference
		Anticipated consequences
		Personal identity (demographic features such as age, gender, ethnic identity, and education, and personal value and belief)
Society-related features	Sociocultural factor	Culture (norms and values)
		Economic variables (Income, socioeconomic status, and price)
		Political elements (Agricultural and food policy and regulations)

Source: Chen & Antonelli 2020.

The development of diverse consumer behavior is fundamentally based on the discovery of positive emotions associated with the consumption process of fulfilling a food need. A need involves a motive for action. Purchasers must feel motivated to make decisions. This motivation arises when a need is not met. Consumers are guided by the following motives when choosing food products [Chamberlain & Broderick 2007]:

- economic – buying a product because of its low price,
- aesthetic – buying a product because of its appearance, color, or taste,
- symbolic – buying a product because of the social position of the buyer,
- instrumental – purchasing a product to satisfy a need.

Therefore, consumers' nature plays an important role in selecting food products. Everyone has a different temperament that influences their perception of the world, their habits, and their ease or difficulty in making decisions. Entrepreneurs are increasingly designing products that reflect the personality traits of particular consumer groups [Olejniczak 2009].

From the perspective of companies offering convenience foods, knowledge of consumer preferences is very important. Studies have shown that busy lifestyles, demanding work schedules, and numerous responsibilities within the context of limited time are the main factors that significantly influence consumers' intention to purchase and consume these foods [Lemanowicz & Adamska 2023]. The meaning of 'convenience foods' can vary by industry. In the bakery industry, for example, convenience foods are buns or cakes, while in the meat industry, they are burgers. In general, however, the term most often refers to frozen, chilled, or canned foods; snacks and confectionery; takeout food; and ready meals [Jackson & Viehoff 2016].

Globally, the term 'convenience food' has a longer genesis than in Poland, as it dates back to the 1960s, when a definition proposed by the National Food Survey was adopted, recognizing that it is 'processed food whose high level of culinary preparation allows it to be used as a labor-saving alternative to less processed products' [Adamczyk 2010, p. 5-13]. However, in Poland, the term emerged in 1993, when it was first translated and defined as 'food that requires minimal labor and a brief preparation time for consumption' [Janicki 1993, p. 227-230].

Consumers in the food market are becoming more demanding. The perpetual shift in dietary trends, the diminution of product life cycles, fierce competition, and the evolving lifestyles of consumers have led to an expectation that food not only satisfy fundamental needs such as hunger, but also address the desires of consumers. These desires encompass the reduction of meal preparation time, the promotion of health, and the minimization of environmental impact. This condition is emerging as a salient factor in the realm of product innovation development within the food market. The degree of product innovation is subject to constant change and is linked to the evolution of consumer needs and preferences. Changes expressing the degree

of novelty can refer to different dimensions of the product, and can therefore relate to its functionality, appearance, or convenience of use. From the perspective of the consumer, the comparison of changes, features, and characteristics of the product against needs and expectations is a determining factor in the innovativeness of the product [Lemanowicz & Szwacka-Mokrzycka 2014].

Companies continually monitor their customers' preferences and emerging trends. This strategy enables businesses to address consumer demands and expectations, while concurrently achieving a competitive advantage and securing a leadership position in the market. The objective of product or marketing innovations is twofold: first, to expand the range of products offered; and second, to initiate new distribution channels and develop consumer communication strategies. In the context of the food market, companies engage in a competitive dynamic characterized by the extent of innovation they introduce. In the context of a volatile and competitive environment, innovation has emerged as a critical factor for organizations seeking to maintain their competitive edge. Consequently, it is imperative for stakeholders to be cognizant of the various product innovations that are shaping the industry [Czupilowska 2014].

In the contemporary business landscape, a company that fails to innovate and enhance its existing products and services may find itself unable to compete with more forward-thinking enterprises. The process of developing new products entails considerable expenses, inherent risks, and the utilization of substantial resources. In order to successfully launch a new product in the marketplace, a company must first define its mission, establish its objectives, determine its market position, and assess its growth potential [Jasiulewicz 2016]. Consequently, trends in agri-food systems present challenges to farmers, entrepreneurs, processors, and other stakeholders, compelling them to enhance the efficiency of their operations and demonstrate greater responsiveness to consumer needs [Lemanowicz & Szwacka-Mokrzycka 2014].

In the contemporary food market, characterized by an abundance of options, manufacturers find themselves compelled to introduce innovations that align with the needs and expectations of consumers. Consumer needs are evolving to prioritize convenience, as evidenced by the growing demand for expeditious and uncomplicated food preparation, straightforward storage methods, and packaging that incorporates functional characteristics, such as resealable and preheatable options. In the food sector, product convenience is a pivotal driving factor.

The purpose of the study was to determine the impact of product innovations on consumer purchasing behavior, using convenience foods as an example. Studying consumer behavior involves obtaining primary and secondary information to recognize the many phenomena and processes related to market choices, decision-making, and their consequences.

1. MATERIAL AND METHODS

The characteristics of the study population are as follows:

A group of 200 respondents residing in the Małopolska Voivodeship took part in the survey. Women comprised 58% of the population surveyed, while men comprised 42%. Of those surveyed, 60% were young adults aged 18–29. The low percentage of people aged 50 and over (Figure 1) is probably due to the fact that the research was conducted using voluntary online invitations, which did not effectively reach these age groups. Due to the research method adopted, the survey is not representative of the entire country's population.

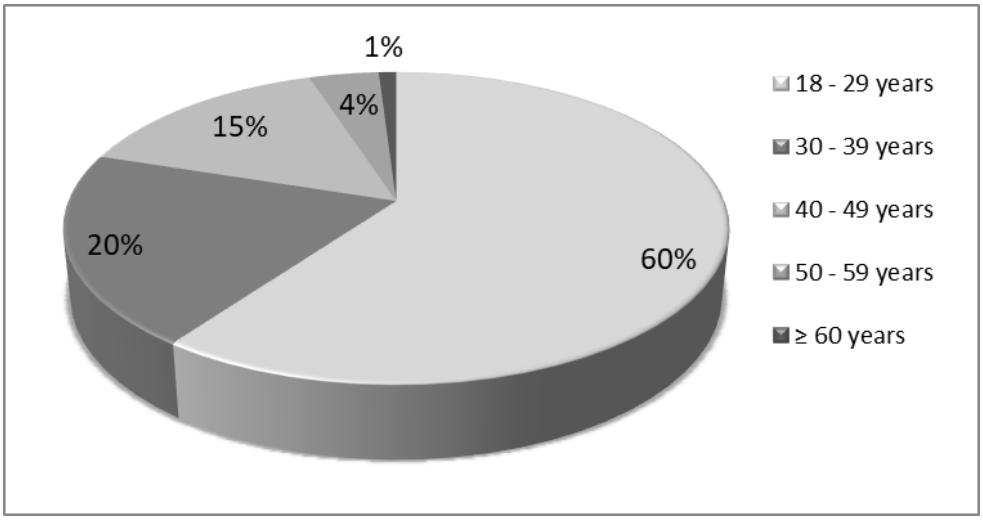

Figure 1. The structure of the surveyed community shown by the age of the respondents

Source: own study.

88% of the study group described their education as tertiary or secondary. Those with primary or vocational education accounted for 5% and 7% of respondents, respectively. Respondents were characterized by a high degree of diversity in terms of place of residence:

- 24% lived in a city with more than 500,000 inhabitants.
- 19% lived in cities with 150,000 to 500,000 inhabitants.
- 14% lived in a city with 50,000 to 150,000 inhabitants.
- 31% lived in a city with fewer than 50,000 inhabitants.
- 12% lived in the countryside.

Only 4% of respondents rated their material situation as 'very good', and 15% rated it as 'good'. More than half (52%) described their material situation as average. Just over a fifth (22%) rated their material situation as unsatisfactory, and 7% rated it as bad.

1.1. Research methodology

The research used a diagnostic survey method. The survey was carried out using a proprietary online questionnaire and the CAWI (Computer-Assisted Web Interviewing) technique. The survey was anonymous and addressed to residents of Małopolska. Consisting of 21 questions, it was posted online at webankieta.pl. The questionnaire contained mainly closed questions; only one required an open answer. Respondents who selected 'other' were allowed to elaborate. The closed questions used measurement scales, including nominal and range scales.

2. PRESENTATION AND DISCUSSION OF RESEARCH RESULTS

The dynamic nature of food market development makes it difficult for consumers to clearly define a new product. When asked to define the term 'product innovation/new product', more than half of the respondents said it is any product with a new taste, texture, or form – in other words, any modification to a product. Fewer respondents understood it as introducing a product that was previously absent from the market (Figure 2).

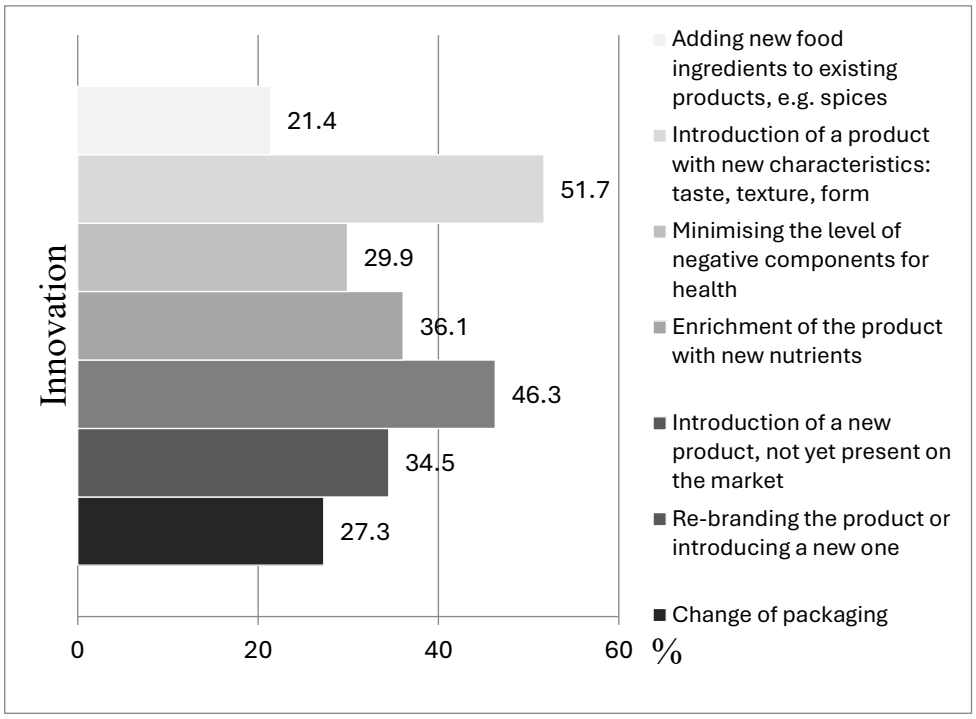

Figure 2. The way consumers think about new products in the food market

Source: own study.

One in three respondents understands product innovation to mean rebranding a product. A similar percentage of respondents view product innovation as enriching a food product with new nutrients. For 27.3% of respondents, changing the packaging is a product innovation, as is minimizing the level of negative health ingredients for 29.9% of respondents. One in four residents of Małopolska considers adding new ingredients to food an innovation.

Food consumers have a broad understanding of product innovation. According to Table 2, 45.1% of respondents are unable to evaluate their knowledge of innovative products. Only one in six respondents confirmed having very good or good knowledge in the area in question. One in three respondents admitted to having a lack of knowledge about new products. Taking into account the promotional campaigns of new food products carried out by producers, the result obtained allows one to make a statement that Polish consumers are strongly conservative.

Table 2. Respondents' declaration of their level of knowledge about new food products in Poland

Declaration	Responses [%]
I know the new food products very well	2.1
I know the new food products well	15.2
Difficult to say	45.1
Poorly	28.5
I don't know the new products on the food market at all	9.1

Source: own study.

The next question examined the attitudes of surveyed residents of Małopolska towards purchasing new products. The research found that respondents' willingness to purchase food product innovations is influenced by their age and gender (Figures 3 and 4).

Figure 3. Attitudes toward new food products by gender of consumers [%]

Source: own study.

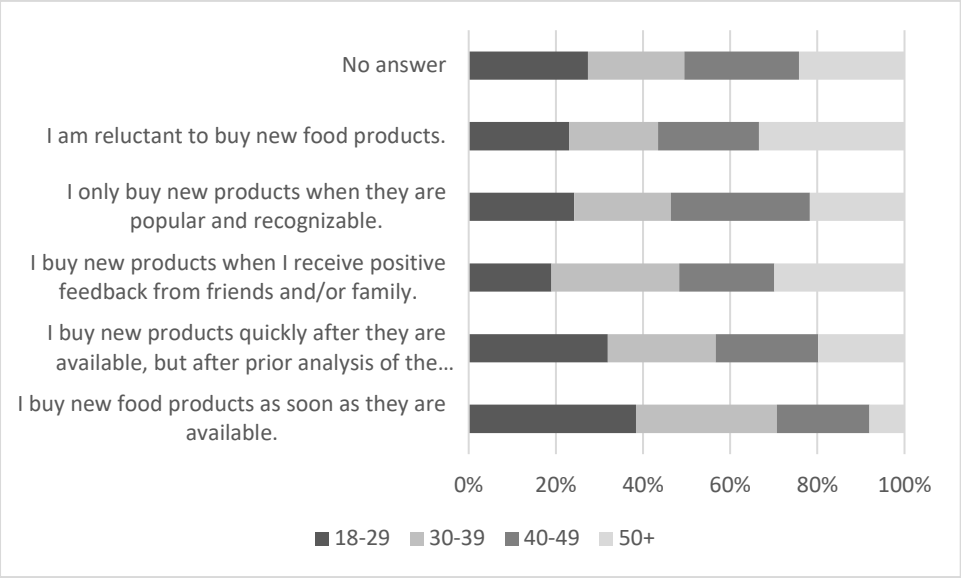

Figure 4. Attitudes toward new food products by consumers' age (in %)

Source: own study.

As can be seen, young consumers are more likely to purchase new food products than older consumers. A similar relationship exists between men and women: women are more likely to buy innovative food products, which may be due to men's greater conservatism on this issue. As respondents' age increases, their reluctance to purchase new products also increases. People over 50 primarily base their decisions on positive recommendations from family or friends. The research also showed that urban consumers who describe their financial situation as satisfactory or good are more likely to purchase an innovative product than rural consumers or those who are dissatisfied with their financial situation.

Figure 5 shows respondents' opinions about their purchasing habits. Over 90% of respondents purchase products they are familiar with and regularly consume. Here, the conservatism of Małopolska regarding the purchase of new food products is evident. Only one in five respondents declares that they purchase innovative, previously unknown products. The study also shows that young people are more open to new products than older consumers.

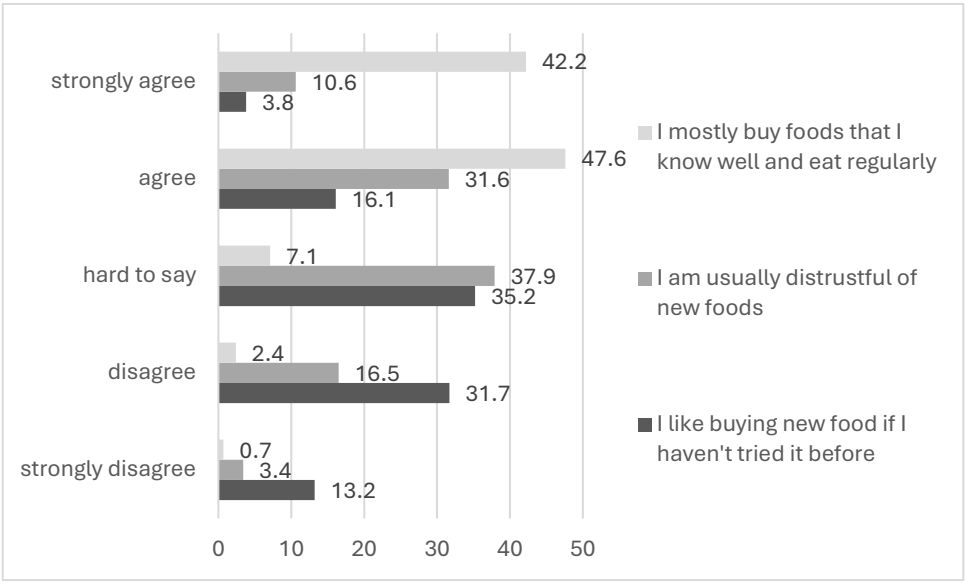

Figure 5. Declaration of respondents on their food shopping habits (in %)

Source: own study.

When purchasing new food products, consumers' decisions are influenced by several factors: attitude toward innovative products, knowledge about them, gender, age, place of residence, and financial situation. A reluctant attitude toward product innovation when purchasing food is due to a lack of knowledge as well as conservatism and pragmatism in consumers' attitudes toward new products and consequently, their purchases. This attitude is prevalent among men, individuals over 50, rural and small-town residents, and consumers who rate their financial situation as average or poor.

The survey also asked respondents to define 'convenience food'. The consumer responses were very diverse:

- 34.1% of respondents could not define the term.
- One in three respondents defined convenience food by its simplest connotation: products intended for quickly preparing a particular meal.
- 13.7% of respondents defined convenience food as products that are easy to use during preparation and consumption.
- The remaining group of respondents defined convenience food as products intended for direct consumption that require minimal cooking or are fast food.

Next, the frequency with which consumers purchase specific categories of convenience foods was examined. This made it possible to assess which categories are most popular. The results revealed a purchasing pattern for convenience food products. Frozen mixes of unprocessed vegetables and frozen fish and chips were the most frequently purchased products. Respondents purchase products such as chilled or ready-made deli dishes, frozen meal mixes, and frozen soups less frequently than once a month. New food categories that appear on the market, such as frozen oriental dishes, do not meet consumer interest. Young consumers are more likely to buy frozen pizzas, fries, and chilled or glass-packed dishes. Older consumers prefer products that require cooking, such as frozen fish and raw mixes.

For businesses, knowing why consumers buy convenience food products is important because it allows them to predict shoppers' reactions and promote products accordingly. New in-store products ranked last in the hierarchy of reasons for purchasing convenience foods. This finding corroborates previous research results, suggesting that Poles are reluctant to buy new products due to their conservative attitudes toward food.

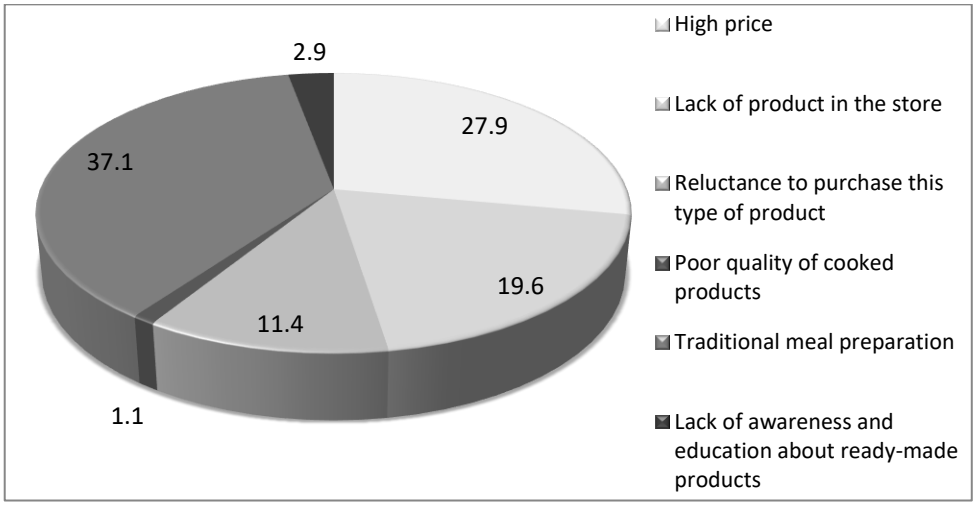

Figure 6. Barriers to the purchase of convenience foods (in %)

Source: own study.

From a market development perspective, the barriers to purchasing convenience foods are an important aspect. According to the survey results, more than 37% of respondents believe that the main barrier to purchasing these foods is their desire to prepare meals the traditional way. Another factor limiting purchases is the high price. One in two respondents said they are reluctant to purchase convenience foods, and 19.6% said the barrier is the lack of products offered in stores (Figure 6).

From the perspective of the convenience food manufacturer, another important issue is understanding the factors that influence consumers' willingness to purchase products in this segment. Figure 7 shows the factors that influence consumer interest in a product. For more than 60% of respondents, the most important incentive to purchase is a reduction in product price. One in five respondents said they would buy a convenience food product if the manufacturer offered a promotion. 10% of respondents said that an interesting new product range on the food market would motivate them to buy.

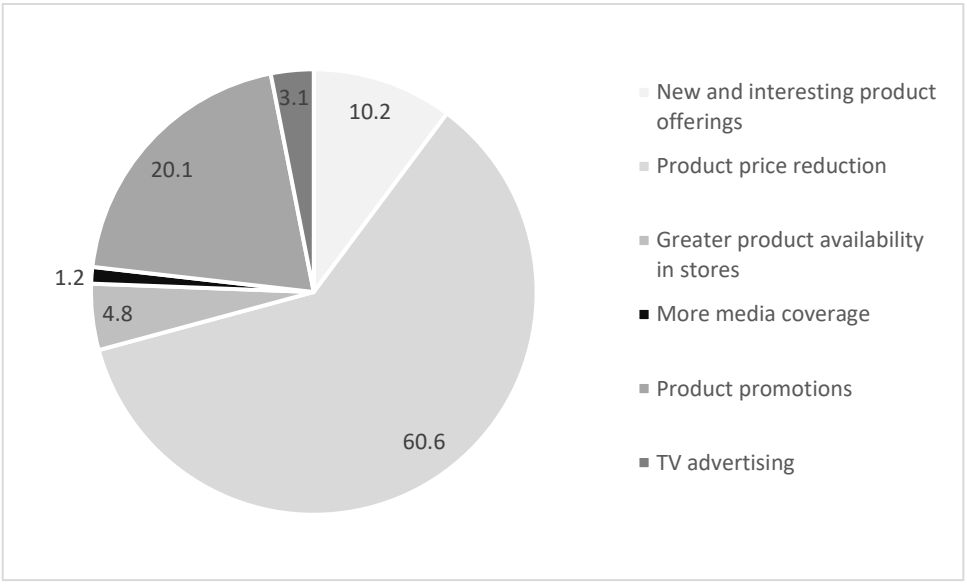

Figure 7. Motivators for buying convenience foods (in %)

Source: own study.

Changes in consumer habits and trends have made convenience foods increasingly popular. Since buyers are guided by a number of factors during the purchasing process, an attempt was made to investigate the importance of these elements when purchasing new convenience foods (Figure 8).

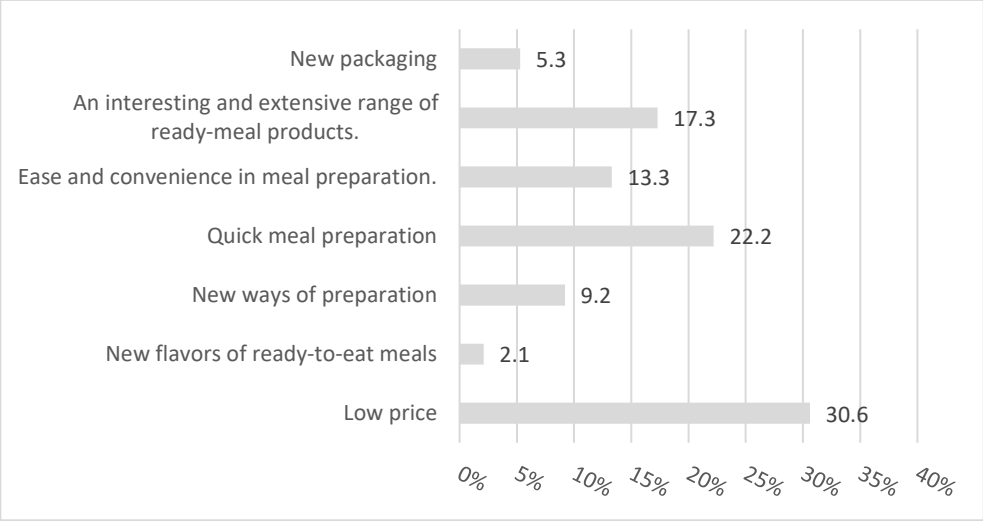

Figure 8. Factors that encourage consumers to buy new ready-made meals (in %)

Source: own study.

Nearly one in three respondents pointed to low prices as an encouraging factor for purchasing product innovations in the convenience food sector. Another important factor is the ability to prepare a meal faster (22.2%). Respondents also mentioned factors such as an interesting and extensive range of ready meals (17.3%) and the ease and convenience of meal preparation (13.3%).

Consumer attitudes influence opportunities for product innovation in the convenience food sector. These attitudes strongly influence consumers' purchasing decisions. Respondents have a positive attitude toward new convenience food products. Over 80% of respondents said that these products make life easier. Another important statement made by respondents was that innovative products give customers more choices (68%). Attitudes change with age: among those over 50, more than one-third declared that new convenience food products are slightly different from traditional dish preparation methods.

The final step was to investigate which elements influence the purchase of new products in the convenience food market. The research shows that consumers are interested in new products in this market if the products meet the following criteria:

- reduce preparation time (38.3% of respondents),
- have a positive health impact (25.2% of respondents),
- have an increased shelf life (19.8% of respondents), and
- do not require complicated culinary processing during meal preparation (16.7% of respondents).

For young consumers, the main factor influencing the purchase of new convenience food products is how quickly and easily meals can be prepared. Reducing the product's price mainly encourages consumers over 40 years of age. Respondents who describe their financial situation as satisfactory are significantly more interested in the product's health benefits.

In Poland's food market, consumers have a wide selection of products that align with their dietary preferences and habits. Changes in consumer habits and behavior result in new products. A survey was conducted to determine the changes in eating habits among consumers due to the introduction of innovative products in the food market. The survey yielded the following results (respondents' answers do not add up to 100% because they could choose more than one answer):

- 57% of respondents do not significantly change their eating habits and prepare meals from purchased raw materials.
- 42% of respondents use semi-finished products to prepare a specific dish.
- One in three respondents purchases slightly processed convenience food.
- 18% of respondents admitted that new food products on the market changed their eating habits, causing them to increasingly buy processed food and limit meal preparation to heating things up in the microwave or oven.

The results of the study show that men's eating habits are influenced more by the introduction of new food products on the market than women's are. Men are more likely to prepare meals by buying ready-made products. 30% of men prepare dishes by cooking and seasoning them, while 25% of respondents admit that innovative products allow them to prepare meals by heating them up in the microwave or oven.

Respondents' age has the greatest impact on how product innovations influence eating habits. Young consumers under 30 years old consume larger amounts of

processed food (44.5%) than other respondents, who say acquiring new food products only helps prepare specific meals.

Respondents who described their financial situation as average or satisfactory were far more likely to purchase convenience food products, thereby changing their eating habits. Interestingly, respondents with a very good financial situation are not willing to change their nutritional habits. More than 60% of them do not purchase ready-to-heat processed products.

Place of residence also plays an important role in changes to consumer behavior. Inhabitants of large cities change their food consumption habits much more quickly than those in other areas, especially when new products are introduced. This is due to the fast pace of consumer life and limited time for meal preparation.

Thanks to the results obtained, we can conclude that Polish consumers are not a homogeneous group when it comes to purchasing processes, perceiving product innovations, or willingness to change their eating habits. Their perception of product innovations varies greatly depending on their age, gender, education level, place of residence, and financial situation.

CONCLUSIONS

Understanding the need for convenience foods is the first step in analyzing a consumer behavior model that shows their patterns in the market. The decision to purchase a new convenience food product is influenced by biological factors (e.g., hunger), economic factors (e.g., income), demographic factors (e.g., age and gender), and geographic and natural factors (e.g., place of residence). Satisfying the buyer's needs begins with seeking information about new food products. Consumers obtain information from sources they believe to be reliable, such as market communication (including the media), the opinions of family and friends, tastings at points of sale, and innovative sources resulting from their own initiative and desire to learn more, such as the internet and travel abroad. The choice of information source depends on the consumer's knowledge and experience. A very important factor in product purchase is the consumer's attitude toward product innovation. Those who accept change are more likely to purchase new products in the convenience food category. The final phase of the purchase process in the convenience food market is consumers' post-purchase behavior. The study's results

showed that consumers evaluate products in this sector based on economic factors, such as price, and the attributes of convenience food, such as ease of preparation and short preparation time.

Based on the results of the research, we can conclude that the main factors influencing changes in consumer behavior due to a new convenience food product include the following:

- Internal factors: demographic, sociocultural, and geographic-natural.
- Previous eating habits (conservatism and traditionalism).
- Knowledge of convenience foods and their main characteristics.
- Information and belief in the advantages of products in this category.

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THE ROLE OF EMOTIONS IN THE PERCEPTION OF PRODUCT QUALITY BASED ON ITS LABEL

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Abstract

The study examines the role of emotions in shaping the perceived quality of a product based on its label. The aim of the study is to analyze how visual label components (color, typography, material, layout) trigger affective and cognitive processes that influence consumer evaluations. The research adopts a qualitative, theoretical approach, relying on a critical literature review and secondary data analysis. Sources were collected from major academic databases, including Scopus, Web of Science, and Google Scholar, selected for their broad coverage of psychology, consumer behavior, neuromarketing, and visual communication studies. The findings indicate that label design functions not only as an informative tool, but also as a medium of affective communication, significantly shaping consumer attitudes, perceived quality, and purchase intention. The study concludes that effective label design requires alignment with cultural context, consumer involvement level, and brand strategy to build trust, stimulate curiosity, and strengthen product value.

Keywords: emotions, consumer perception, product label, visual identity, affective marketing.

INTRODUCTION

The concept of emotion originates from the Latin word *emovere*, meaning 'to move out' or 'to stir' [Buss 2025]. Emotions are biologically encoded responses to environmental stimuli. They can be understood as a combination of mental evaluative processes and physiological reactions, involving both changes within the body and neural activity in the brain. These processes constitute the so-called emotional state, resulting from the interaction between physiological systems and cognitive responses [Damasio 2011].

Schwarz [1990], who conceptualized emotions as a source of environmental information, demonstrated that emotional states influence stimulus interpretation and situational judgment. His work highlighted the significant role emotional factors play in shaping individual preferences and decision-making processes – particularly in the context of consumer behavior.

Consumer perception is therefore not solely the outcome of rational analysis but is closely intertwined with emotional components. Contemporary consumer psychology underscores that purchasing decisions are largely driven by affective impulses, which influence the subjective evaluation of a product. Notably, the product label – as the consumer's initial point of contact – serves as a visual stimulus that activates emotional and cognitive processes, shaping early perceptions of product quality.

The graphic components of a label – such as color, typography, material texture, and layout – function as carriers of both meaning and emotion, often processed automatically and unconsciously. These responses are governed by neurocognitive mechanisms involving both the limbic system (associated with emotional processing) and the cortical areas responsible for rational evaluation. Of relevance here is neuromarketing research, which enables the analysis of consumers' emotional responses to visual stimuli using tools such as EEG or facial expression tracking.

As such, a label can evoke associations with product quality, heritage, innovation, or prestige – subsequently influencing consumer attitudes and behavior. Label design becomes an act of visual communication, the effectiveness of which depends on its ability to trigger positive emotional responses and align with the expectations of the target audience.

This study seeks to examine the affective and cognitive processes activated by label design elements and to assess their role in shaping the perceived quality

of a product. The aim of the study is therefore to explore how emotions, triggered by visual label components, influence consumer quality perception and to identify their implications for marketing and design strategies.

1. MATERIAL AND METHODS

The study is of a theoretical and conceptual nature, in which the results of empirical research and theoretical achievements in the field of psychology of emotions, consumer behavior, neuromarketing and visual design are integrated. The literature review included both classical concepts about the nature and function of emotions [Damasio 2011; Schwarz 1990] and contemporary approaches used in the analysis of purchasing behavior [Cialdini 2017; King et al. 2013; Muruganantham & Bhakat 2013].

The literature review was conducted using academic databases including Scopus, Web of Science, and Google Scholar. These databases were selected because they provide comprehensive coverage of research in psychology, consumer behavior, marketing, and visual communication, ensuring both relevance and scientific quality of the sources.

Secondary sources were analyzed, including the results of empirical research published in peer-reviewed scientific journals and reports on the impact of visual components (colors, typography, label material) on the perception of quality and consumer behavior. A special place in the analysis was occupied by research in the field of neuromarketing and experiments using techniques for measuring emotional reactions (EEG, fMRI, facial expression analysis), which enabled an in-depth recognition of the affective component of label perception.

The selected research strategy made it possible to identify visual factors affecting the emotional perception of the product, to reconstruct the psychological mechanisms activated during consumer contact with the label, and to juxtapose typical design patterns with their communicative and affective functions. This allowed us to formulate application-specific conclusions regarding the design of labels and product packaging in a way that is conducive to evoking the desired emotional reactions and positive perception of quality.

2. RESULTS

2.1. Emotions in consumer decision-making

Emotions constitute a fundamental component of consumer decision-making, influencing both the mode of information processing and product evaluation. The literature distinguishes several levels of affective intensity, including primary emotions (e.g., fear, anger), secondary emotions (e.g., interest, shame), high arousal affects (e.g., ecstasy, terror), as well as more stable states such as feelings and moods [Jachnis & Terlak 1998].

Environmental stimuli – such as music and lighting – can significantly affect consumer mood and behavior. For instance, altering the music in a wine shop from Italian to French has been shown to increase the sale of wines from the respective countries, illustrating the impact of affective cues on purchasing decisions [Cialdini 2017]. Emotional dynamics also play a central role in deliberate purchases, particularly gifts. In such cases, elevated uncertainty, and fear of making an inappropriate choice often drive consumers toward branded, premium products perceived as safer and more reliable [Boncinelli et al. 2019].

Consumer engagement level moderates both the intensity of emotional responses and the depth of cognitive processing. Emotional curiosity – closely linked to engagement – serves as a mechanism through which label design influences perceived quality and purchase intention. Highly engaged consumers exhibit stronger emotional reactions, which translate into higher satisfaction and purchase likelihood [Joshi et al. 2024]. Conversely, low involvement favors habitual behavior and heuristic processing, while high involvement encourages deliberate evaluation, in which emotions serve a motivational function [Cardello & Jaeger 2015].

Positive affect facilitates impulse purchasing behavior, characterized by speed, spontaneity, and hedonic gratification. Under the influence of positive emotions, consumers make decisions more rapidly, with reduced critical analysis and a greater reliance on surface-level cues [Muruganantham & Bhakat 2013]. Such purchases are often triggered by immediate visual or sensory stimuli – such as product appearance – rather than deliberate comparison or evaluation of alternatives.

In response to growing interest in the emotional drivers of consumer behavior, various tools have been developed to assess affective responses. One such method

is the EsSense Profile, which measures emotions elicited by food products using predefined affective indicators [King et al. 2013]. The increasing use of neuromarketing techniques – including EEG, fMRI, and facial expression analysis – enables a more precise examination of consumer responses to marketing stimuli, enhancing understanding of how these cues influence preferences and choices [Wrona 2014].

2.2. Visual perception of labels as an emotional factor

Vision as the dominant channel of perception plays a key role in product evaluation processes, marginalizing the importance of the other senses [Hutmacher 2019]. The label not only has an informative function, but also has a strong emotional impact, affecting the perception of authenticity and brand values.

The color scheme of the label activates specific emotions – warm colors (e.g., yellows, oranges) evoke excitement and optimism, cool colors (green, brown) – trust and peace. Contrasting combinations, such as black and white labels on red wines, can evoke nostalgia. The emotional effect of color, however, is contextual – it depends on the composition of the entire label [Joshi et al. 2024].

The Construal Level Theory (CLT) indicates that culturally rooted labels (e.g., through local symbols or traditional design) shorten psychological distance, strengthening the sense of authenticity. On the other hand, abstract, or exotic forms can arouse anxiety or ambivalence [Trope et al. 2007].

Traditional layouts (symmetry, white background, classic font) communicate prestige, history, and high quality. Typography, including the font style (e.g., blackletter), conveys characteristics such as elegance, seriousness, intensity, or delicacy – influencing the organoleptic perception of the product [Celhay 2022; Celhay & Remaud, 2017]. On the other hand, modern and humorous typography designs (e.g., sans-serif, handwriting) evoke extreme reactions. They can increase curiosity and engagement, especially among younger or more risk-averse consumers, but at the same time lower perceived quality in the eyes of traditional patterns [Lunardo & Rickard 2019]. This effect depends on the layout of the whole – even classic fonts lose their strength when used in a chaotic way. The label material also affects emotions – changing the surface from glossy to textured can improve the visual and sensory evaluation of the product. Minor changes in texture translate into significant differences in the perception of quality [Mind Insights 2019].

2.3. Emotional perception of label and purchasing decisions

In today's consumer environment, the perception of products has become increasingly sophisticated, driven by technological advancement and the growing ability to influence consumers' sensory experiences. Perception, as a cognitive process, has evolved into a strategic marketing tool that provides manufacturers with a significant competitive advantage [Ahmad et al. 2012].

Emotional responses to product labels vary significantly across age groups. Older consumers, whose cognitive activity typically declines with age, are less inclined to experiment with unfamiliar products. They tend to prefer brands that are familiar, trusted, and associated with positive memories. Labels with traditional visual aesthetics can evoke a sense of nostalgia, thus shaping their purchasing decisions [Świda 2013]. In contrast, Generation Z consumers display greater openness to innovation and exhibit heightened sensitivity to labels as affective stimuli. For this demographic, the visual appeal of a label alone may serve as a sufficient determinant of purchase [Ratajczyk 2019].

According to the dual-process model by Metcalfe and Mischel [1999], consumer behavior is governed by two interacting systems: the 'hot' system – affective, impulsive, and rapid – and the 'cool' system – reflective, deliberate, and cognitively complex. The dominance of either system depends on situational context and the emotional state of the consumer. Furthermore, the predictive processing theory suggests that consumers assess unfamiliar products by referencing stored mental representations of similar products, thereby activating affective schemas – either positive or negative [Gładziejewski 2016].

Consumer mood also influences label-based evaluations. Individuals in a positive emotional state tend to attribute more favourable qualities to a product, while those in a negative state exhibit more critical judgment [Schwarz 1990]. This supports the notion that emotions function as cognitive filters during product assessment.

From a behavioral economics perspective, consumer purchasing decisions are inherently subjective and often irrational [Mruk 2017]. Consumers tend to react more strongly to visually salient stimuli – such as label size, vibrant colors, or unconventional design. For example, taller bottles or large-format labels are more likely to attract attention and be selected [Dooley 2016].

Research by Celhay and Passebois [2011] confirms that aesthetically atypical labels can positively influence perceived product value. This phenomenon is explained by the principle of hedonic asymmetry, which posits that emotional responses to novel products are more frequently positive than negative – thereby increasing the likelihood of purchase [King et al. 2013].

2.4. The role of labels in shaping the perceptual quality of the product

Perceived product quality – and consequently, purchase intention – is significantly influenced by the visual features of the label and the consumer's situational context. A key factor in this process is the level of perceived risk. In high-risk situations, consumers tend to prefer traditional labels that adhere to established visual codes of the industry, as these convey a sense of familiarity and quality assurance. In contrast, aesthetically unconventional labels are more positively received in low-risk contexts, where their distinctiveness and visual appeal can enhance product attractiveness [Celhay & Passebois 2011].

Certification symbols are important quality signals embedded within the label. Examples include the EU organic farming logo (the 'Euro Leaf'), which communicates compliance with ecological standards and reinforces consumer trust. Additionally, knowledge of wine classifications – such as the distinction between 'table wine' and appellation-controlled wines – enables more experienced consumers to infer product quality directly from the label [Bryła 2015].

Color also plays a critical role in shaping perception. Dark, muted tones are typically associated with elegance and seriousness, but may deviate from conventional wine aesthetics and elicit ambivalent responses. Conversely, white is linked with cleanliness, ecological awareness, and authenticity. Labels that use a limited and unified color palette are generally easier to recognize and remember [Świda 2013].

Given the limitations of standard label information (e.g., origin, grape variety, vintage), many consumers seek supplementary cues through mobile applications like Vivino. This reflects the growing importance of external sources in complementing label-based judgments. Research indicates that incorporating sensory descriptors and visual symbols on labels can significantly improve perceived product quality [Crichton-Fock et al. 2023].

Technological innovations such as augmented reality (AR) and QR codes are increasingly shaping quality perceptions. While QR codes alone may have limited impact, their integration with AR – as demonstrated by the 19 Crimes brand – can greatly enhance the user experience. In this case, the introduction of AR-enabled labels contributed to a dramatic increase in sales, from USD 4 million to USD 18 million annually, suggesting that label design played a pivotal role in perceived product value [Joshi et al. 2024; Silva et al. 2024].

Effective labelling not only influences quality assessment, but also affects sensory perception. For instance, when consumers believed that a wine was organic, they perceived it as smoother, fruitier, and more enjoyable. This finding demonstrates that external stimuli – such as symbols or graphical cues – can alter the subjective experience of a product's sensory attributes [Apaolaza et al. 2017].

3. DISCUSSION

The product label, as a visual communication tool, activates affective-cognitive mechanisms that shape consumer perception. According to Construal Level Theory (CLT), labels with traditional elements reduce psychological distance, fostering perceptions of authenticity and emotional closeness. In contrast, modern or abstract graphic designs may be perceived as innovative or even risky. The concept of aesthetic dissonance suggests that excessive originality may reduce perceived quality. Effective label design must therefore consider cultural context, target audience characteristics, and aesthetic congruence with the product category. While immersive technologies (e.g., AR) open new design possibilities, their implementation must maintain stylistic consistency.

Findings from secondary data analysis underscore that the label plays a central role in shaping perceived quality primarily by triggering emotional responses. This aligns with the affective-cognitive model of information processing, which posits that emotions and cognition are mutually influential and modulate one another [Lazarus 1991; Schwarz 1990].

Perceptual congruity between label design and consumer expectations enhances brand credibility and coherence. Conversely, incongruity can induce cognitive dissonance or arouse curiosity, depending on the individual's tolerance for risk and personal characteristics. The emotional response to a label is thus context-dependent,

shaped by factors such as age, experience, demographics, and situational variables (e.g., purchasing for oneself versus as a gift).

CLT [Trope et al. 2007] offers a valuable framework for understanding label perception. Designs rooted in tradition and locality reduce psychological distance, eliciting emotions such as nostalgia and trust, thereby increasing perceived product quality. In contrast, minimalist or avant-garde labels may evoke ambivalence – interpreted either as a sign of exclusivity or inaccessibility – depending on cultural and market context.

The materiality of the label – its texture, weight, and typography – also plays a crucial role. As shown in studies by Mind Insights [2019], these tactile features can generate emotional micro-reactions even below the level of conscious awareness. The concept of 'tactile aesthetics' highlights the role of haptic stimuli in evoking trust, perceived quality, and sensory pleasure. Multisensory label design, engaging more than one sense, can amplify emotional responses through perceptual synergy.

Secondary data also show that while a label may evoke a positive emotional reaction, this does not always translate into perceived quality – particularly when the design diverges too far from familiar category norms. This again supports the concept of aesthetic dissonance: an innovative design may capture attention but also generate uncertainty regarding product authenticity or quality [Celhay & Passebois 2011].

Recent research increasingly incorporates neuromarketing tools such as EEG, fMRI, and eye-tracking, enabling the objective measurement of emotional reactions. These technologies enhance our understanding of which label elements activate the limbic system and how different consumer segments respond to various visual styles.

From a practical standpoint, these findings suggest that label design should be approached as an interdisciplinary task – requiring collaboration between graphic designers, consumer psychologists, and sensory marketing experts. The goal is to create emotional visual interfaces: labels that not only convey information, but also engage, resonate, and influence affective evaluation.

The analysis supports the theoretical view that emotions function as cognitive filters in processing marketing stimuli. Labels – through their visual and tactile features – serve as potent tools in shaping perceived quality. According to Metcalfe and Mischel's [1999] dual-system model, labels can activate either the 'hot' system

(affective, reactive) or the 'cool' system (reflective, strategic). A high level of consumer involvement increases the likelihood of deep processing, where emotion enhances evaluative reasoning.

Conversely, low-engagement consumers are more prone to heuristic processing, relying on superficial affective cues such as color or layout. In such cases, the label operates as an 'emotional cognitive shortcut' whose influence may exceed that of the product's objective attributes. This phenomenon aligns with insights from behavioral economics, where emotions are considered integral to decision-making processes.

CONCLUSIONS

The product label constitutes a key emotional element in the perception of product quality. Its visual attributes – such as color, typography, layout, and texture – can foster trust, stimulate curiosity, or convey a sense of prestige. Effective label design requires a nuanced understanding of consumers' affective responses and the socio-cultural context. Integrating insights from emotion psychology and visual design enables the creation of messages that resonate on both cognitive and emotional levels.

The literature review indicates several practical applications of emotional label perception in the domains of brand management, packaging design, and marketing communication strategy. Above all, it is essential for designers and marketers to recognize that labels serve not only an informative but also a profoundly affective function, capable of eliciting emotional responses that directly influence perceived product quality and purchase intention.

Key practical implications include:

- Deliberate design of visual label components (e.g., color, typography, layout, material texture) can effectively elicit specific emotional responses across diverse consumer segments.
- Tailoring the label style to consumer involvement levels and purchase context (e.g., gift-giving vs. routine purchase) enhances the perceived value of the product.
- The inclusion of interactive or digital elements (e.g., augmented reality, QR codes) can increase engagement and perceived quality, especially among younger or tech-savvy consumers.

- The presence of quality certifications and eco-labels not only informs but symbolically reinforces trust and perceived brand credibility.
- Affective responses to label design should be tested using neuromarketing techniques (e.g., EEG, fMRI) or A/B testing to fine-tune visual strategies.

This study adopts a theoretical and review-based approach grounded in secondary data analysis from existing literature and research reports. While this method allows for a broad synthesis of current knowledge, it also imposes limitations regarding the generalizability of empirical insights.

Main limitations include:

- The absence of original empirical research, as study is based solely on secondary data, which may vary in methodology and context.
- A limited cultural scope, since most of the reviewed studies originate from Western markets (e.g., the U.S., Western Europe), which may reduce applicability to other regions such as Central and Eastern Europe.
- The complexity and subjectivity of emotions, which are influenced by cognitive, cultural, and individual factors and are difficult to generalize.

Future research directions should address these limitations by:

- Conducting experimental studies using neuromarketing tools (e.g., EEG, fMRI, eye-tracking) to objectively measure emotional responses to label designs.
- Extending the analysis through cross-cultural comparisons to account for cultural differences in aesthetic perception and emotional associations.
- Segmenting consumers according to decision-making styles (e.g., impulsive vs. analytical) to determine which label designs most effectively trigger emotional engagement across different groups.

This analysis affirms that the product label is not merely a carrier of information – it is a strategic tool of emotional influence, shaping perceptions of quality and driving consumer behavior. Label design must therefore go beyond functionality and embrace psychological and aesthetic principles rooted in affective consumer processing.

A well-designed label – aligned with cultural context, target audience characteristics, and visual language (e.g., color theory, typography, symbolism) – can significantly enhance perceived value, reduce uncertainty, and strengthen emotional bonds with the brand. Future empirical research should continue

to explore this intersection, particularly considering emerging technologies such as artificial intelligence and augmented reality, which may further redefine emotional label perception.

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KNOWLEDGE ABOUT NATURE AND ACCEPTANCE OF HUNTING: A SOCIAL ANALYSIS OF ATTITUDES

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Abstract

This study analyzed the relationship between ecological knowledge and acceptance of hunting, considering socio-demographic factors, in a sample of 500 Polish adults. The findings showed that ecological knowledge was not a significant predictor of hunting acceptance. In contrast, gender, meat-free diet, and contact with hunters were strongly associated with attitudes toward hunting. The highest acceptance was observed among men, those not following a meat-free diet, and individuals with active hunters in their environment. The results highlight that acceptance of hunting is shaped primarily by social and cultural factors rather than ecological knowledge alone.

Keywords: hunting acceptance, ecological knowledge, socio-demographic factors, attitudes, Poland.

INTRODUCTION

The contemporary relationship between humans and nature is becoming increasingly complex, with hunting remaining a significant area within this relationship – a practice historically fulfilling utilitarian, cultural, and managerial functions. Although hunting has evolved from subsistence activity into recreational practice in many countries, its social perception continues to generate controversy [Raftogianni et al. 2022]. The decreasing number of active hunters and the growing separation between urban populations and natural environments underline

the importance of understanding public attitudes toward hunting for effective conservation policy.

The relevant literature emphasizes that hunting, particularly as a wildlife management tool, can contribute to ecological balance, habitat protection, and the financing of conservation activities [Krokowska-Paluszak et al. 2020]. Simultaneously, there is an increasing number of individuals expressing disapproval of animal killing, particularly for recreational purposes, often linked with higher education levels, urbanization, and shifting value systems [Krokowska-Paluszak et al. 2020; Raftogianni et al. 2022].

Attitudes toward hunting are often polarized – proponents view it as an activity facilitating connection with nature, relaxation, and gaining ecological knowledge, whereas opponents highlight ethical issues and animal welfare concerns [Enck et al. 2000; Reiter et al. 1999]. Another influential factor shaping these attitudes is the level of ecological knowledge. Research indicates that individuals with greater ecological and biological understanding of wildlife tend to show higher acceptance of hunting, especially in the context of population management [Raftogianni et al. 2022].

Within the global trend known as the 'extinction of experience', caused by urbanization and alienation from nature [Pyle 2003], ecological education and outdoor experiences (such as hunting) are becoming increasingly significant. Understanding the relationship between ecological knowledge and attitudes toward hunting may provide valuable insights for planning social, educational, and environmental policies.

The aim of the study was to assess whether the level of ecological knowledge significantly predicts attitudes toward hunting, taking into account the respondents' sociodemographic context.

The following hypotheses were proposed:

- H1: A higher level of ecological knowledge is significantly associated with greater acceptance of hunting as a tool for wildlife population management.
- H2: Individuals reporting personal contacts with hunting in their environment (family, acquaintances) exhibit higher acceptance of hunting compared to individuals without such contacts.
- H3: Men exhibit higher acceptance of hunting compared to women.
- H4: Individuals following a meat-free diet demonstrate lower acceptance of hunting than individuals who do not follow such a diet.

- H5: Higher acceptance of hunting is significantly associated with the combination of three factors: being male, not following a meat-free diet, and having personal contacts with hunters.

Social Perceptions of Hunting

The societal perception of hunting is multidimensional and depends on various cultural, social, and educational factors. Comparative studies conducted in the USA and Europe consistently demonstrate that acceptance of hunting increases when motivated by practical purposes – such as obtaining meat or resource conservation – but significantly decreases when associated with trophy or purely recreational hunting [Byrd et al. 2017; Krokowska-Paluszak et al. 2020]. Research conducted by Decker et al. [1993] among American populations showed higher acceptance of hunting among older individuals, men, and rural residents, particularly in communities where hunting has traditionally been part of family or societal customs.

Analogous studies conducted in Greece by Krokowska-Paluszak and colleagues [2020] indicated that societal perceptions of various wildlife management practices – including hunting – were strongly influenced by moral values, gender, and levels of urbanization. Urban dwellers were significantly more likely to oppose animal culling regardless of management context. Simultaneously, acceptance increased when respondents demonstrated higher knowledge of predators' roles in ecosystems and understood the objectives of population control.

Findings from Raftogianni et al. [2022] indicate that direct or indirect relationships with hunting significantly shape attitudes. Individuals who reported knowing someone involved in hunting showed greater acceptance of the practice, both in utilitarian and recreational dimensions. Similar patterns are observed in American research – individuals with experience handling firearms, interaction with nature, or participation in hunting traditions expressed higher acceptance of hunting [Decker et al. 1993; Enck et al. 2000].

The social image of hunters also significantly influences public opinion. As noted by Byrd et al. [2017], for respondents in the USA, acceptance of hunting was closely linked to perceptions of hunters – as responsible wildlife managers or, conversely, as brutal and unethical individuals. This image is shaped by media, films, news reports, as well as formal and informal education.

In studies conducted in Spain [Suárez-Tangil et al. 2023], respondents – both hunters and non-hunters – significantly overestimated predator populations, such as

foxes, wolves, and raccoon dogs. Misperceptions about these populations and their attributed negative impacts on game species and ecosystems resulted in greater support for predator control, including through culling. These results underscore the strong influence of emotions and subjective beliefs, which often do not align with scientific data.

In Poland, comprehensive public opinion studies regarding hunting on a comparable scale are lacking. However, observations from original research and increasing social tensions around wild boar and moose culling suggest similar tendencies: high emotional involvement, declining trust in managing institutions, and clear polarization of opinions. Against this background, ecological education and exposure to scientifically-based information can play a crucial role in mitigating conflicts and building acceptance for conservation activities, including hunting as a wildlife management method.

Ecological Knowledge as a Predictor of Attitudes Toward the Environment and Hunting

Ecological knowledge, defined as the understanding of ecological processes, biological interspecies relationships, and organismal functions within ecosystems, plays a significant role in shaping individual attitudes toward the environment. This influence is particularly evident in evaluations of wildlife population management practices, such as hunting. Increasingly, studies suggest that the level of ecological knowledge can predict both positive and negative attitudes toward hunting and, more broadly, toward interventions in nature.

Research by Raftogianni et al. [2022] demonstrated that knowledge of wildlife and ecology influenced perceptions of hunting among both hunters and individuals not affiliated with hunting. The study found that individuals with higher ecological knowledge were less likely to hold extremely negative attitudes toward hunting and more likely to view it as a means of population control and ecosystem protection.

Similar conclusions emerge from research by Riley et al. [2003], who indicated that a lack of understanding regarding the role of hunting in wildlife population management leads to oversimplified assessments and decreased social acceptance of this form of environmental intervention. Knowledge acts as a cognitive filter, enhancing comprehension of hunting's role in maintaining ecological balance, resulting in more moderate and informed attitudes.

According to the Southeastern Association of Fish and Wildlife Agencies (SEAFWA) integrating ecological education with wildlife management programs is necessary. The organization pointed out that individuals better informed about local species and their ecological functions are more likely to accept scientifically informed decisions, including hunting and wildlife control activities. Additionally, the authors noted that awareness of human-wildlife conflicts, such as agricultural damage, is strongly dependent on the ecological knowledge about particular species [Peterson et al. 2009].

Moreover, analyses published in PLOS ONE indicate that perceptions regarding management actions, such as culling or population reductions, vary according to respondents' ecological knowledge. Respondents with lower levels of ecological understanding were more likely to perceive these actions as unethical or unnecessary, whereas better-informed individuals associated them with effective management and biodiversity conservation.

The role of ecological education, both formal and informal, is also noteworthy. Lamanauskas [2003] argues that contemporary ecological education frequently fails to prepare students and citizens adequately to understand complex ecological interdependencies. The authors advocate for educational reforms that better equip society for informed participation in public debates regarding controversial practices like hunting.

In conclusion, ecological knowledge can serve as a significant predictor of attitudes toward hunting and other forms of human environmental intervention. It facilitates understanding of complex ecological processes and encourages more balanced and less emotionally-driven societal responses. Employing a synthetic knowledge indicator in statistical analysis, as conducted in the current study following the model by Raftogianni et al. [2022], enables quantification of this influence and identification of potential directions for educational interventions.

1. MATERIAL AND METHODS

1.1. Research method

The study employed the Computer-Assisted Web Interviewing (CAWI) method, in which responses are collected online. In this study, data were collected

using Google Forms. A link to the questionnaire was publicly available and distributed on Facebook. Additionally, the snowball effect was utilized, encouraging participants to forward the survey to their acquaintances.

The CAWI method was selected due to several advantages:

- Lower implementation costs by eliminating the need for interviewers or printed materials.
- Faster and easier data analysis through automatic collection into a database.
- Enhanced participant anonymity, particularly advantageous for sensitive and emotional topics such as hunting.

However, CAWI also has certain limitations:

- Potential bias toward younger, more digitally active groups.
- Limited to individuals with internet access and digital literacy skills.

1.2. Questionnaire design

The questionnaire consisted of three sections:

1. Attitudes toward hunting: 10 items rated on a 1–5 Likert scale, based on the construction by Raftogianni et al. [2022].
2. Ecological knowledge: 20 questions related to biological and ecological facts (e.g., diet, habitats, animal behaviors), also rated on a 1–5 scale, based on Raftogianni et al. [2022].
3. Sociodemographic variables: gender, age, education, place of residence, personal contacts with hunting, dietary habits, and subjective evaluation of economic status.

Recoding procedures included reversing negatively phrased questions (e.g., 'hunting endangers species') and converting textual responses (e.g., 'strongly disagree') into numerical values (e.g., 1).

1.3. Sample and recruitment procedure

Data collection occurred between October 15 and November 18, 2023. The final analysis included 500 correctly completed questionnaires. The sociodemographic structure of respondents is presented in Table 1.

1.4. Data analysis procedure

Data were recoded in Excel, and analyses were performed using Python (libraries: pandas, statsmodels, scipy, matplotlib).

Attitude and knowledge scales were calculated as arithmetic means following the methodology of Raftogianni et al. [2022]:

- Attitude indicator: mean score from 10 items (scale 1–5).
- Knowledge indicator: mean score from 20 items, following appropriate recoding (scale 1–5).

Descriptive analyses (frequencies, percentages) were used to characterize the sample, presented in tabular form.

Differences between groups (e.g., gender, dietary habits, contacts with hunting) were assessed using independent samples t-tests (for two groups) and Analysis of Variance (ANOVA) (for more than two groups), supplemented by post-hoc Tukey tests when significant differences were identified.

Relationships between quantitative variables were examined using Pearson's linear correlation analysis.

The influence of selected factors on hunting acceptance was assessed through linear regression analysis (for single predictors) and multiple regression (for several predictors simultaneously), including the determination of slope coefficients, significance levels (p-values), and the coefficient of determination (R^2).

All statistical analyses were conducted with a significance level set at $\alpha = 0.05$.

Table 1. Sociodemographic structure of respondents

Variable	N	[%]
Gender		
Female	408	81.6
Male	92	18.4
Age		
18–24	273	54.6
25–34	136	27.2
35–44	55	11.0
>45	36	7.2
Education		
Vocational	18	3.6

cont. Table 1

Secondary	91	18.2
Undergraduate studies (ongoing)	148	29.6
Bachelor's or Master's degree	243	48.6
Place of residence		
Village	144	28.8
Small town	127	25.4
Large city	229	45.8
Personal contacts with hunters		
No	395	79.0
Yes – formerly	36	7.2
Yes – currently	69	13.8
Meat-free diet		
No	435	87.0
Yes	65	13.0
Economic situation		
Below average	32	6.4
Average	353	70.5
Above average	115	23.1
Nutritional knowledge		
Insufficient	28	5.6
Sufficient	207	41.4
Good	219	43.8
Very good	46	9.2
Diet quality		
Very poor	11	2.2
Poor	107	21.4
Good	352	70.4
Very good	30	6.0

Source: own study.

2. RESULTS

To verify H1, which posited that a higher level of ecological knowledge is significantly associated with greater acceptance of hunting as a tool for wildlife population management, a linear regression analysis was conducted. The dependent variable was the synthetic indicator of attitudes toward hunting, while the predictor

was the ecological knowledge indicator, constructed based on the average number of correct answers to biological knowledge questions.

The analysis showed that the regression coefficient (β) for the variable 'ecological knowledge' was 0.13. The model explained only 0.65% of the variance in attitudes toward hunting ($R^2 = 0.0065$). This result did not reach statistical significance ($p = 0.0725$; $\alpha = 0.05$), indicating that, in the studied sample, the level of ecological knowledge was not a significant predictor of acceptance of hunting.

Accordingly, H1 was not supported – no significant association was found between the level of ecological knowledge and acceptance of hunting in the analyzed sample.

The obtained results are presented in a scatter plot with the regression line (Figure 1).

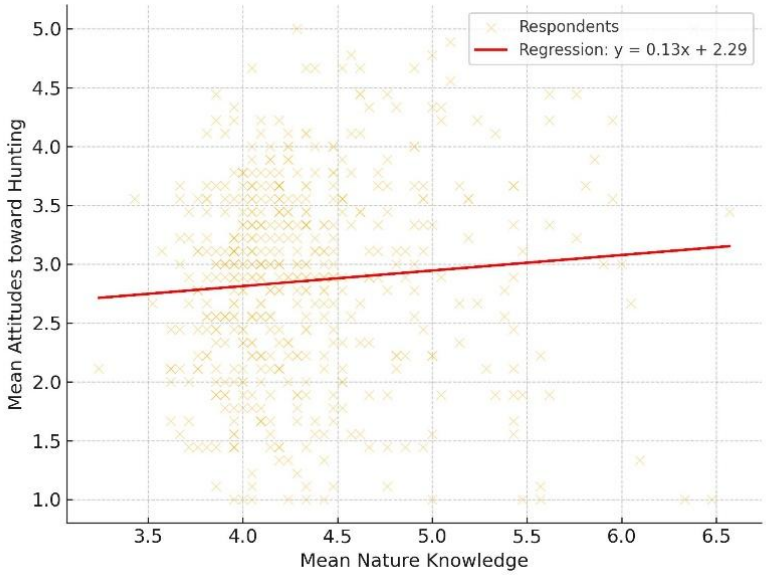

Figure 1. Relationship between the level of ecological knowledge and the indicator of attitudes toward hunting – linear regression model (N = 500)

Source: own study.

In light of the above results, it can be concluded that the relationship between ecological knowledge and attitudes toward hunting was very weak and statistically

insignificant in the analyzed sample. This suggests that acceptance of hunting may be determined primarily by other factors, such as demographic characteristics, previous experiences, or social beliefs, rather than by the level of ecological knowledge itself. These findings are consistent with the observations of Riley et al. [2003] and Raftogianni et al. [2022], who noted the multifactorial nature of attitudes toward wildlife management practices.

H2. Individuals reporting personal contacts with hunting in their environment (family, acquaintances) exhibit higher acceptance of hunting compared to individuals without such contacts.

To verify this hypothesis, the mean indicators of attitudes toward hunting were compared across three groups:

- no contact with hunting,
- contact only in the past,
- current contact (active hunters in the environment).

The results are presented in Table 2.

Table 2. Attitude indicators toward hunting depending on personal contact with hunters

Contact with hunting	N	Mean attitude indicator	Standard deviation
No contact	395	2.83	0.85
Contact in the past	36	2.91	0.84
Current contact	69	3.28	0.82

Source: own study.

Analysis of variance (ANOVA) revealed significant differences between groups ($F = 8.47$; $p < 0.001$). Post-hoc Tukey tests indicated that individuals reporting current contact with hunting exhibited significantly greater acceptance of hunting compared to those with no contact ($p < 0.001$) and those with contact only in the past ($p = 0.03$). No significant differences were found between the 'no contact' group and the 'contact in the past' group.

These results are also supported by multiple regression analysis, in which having active hunters in one's environment was the strongest positive predictor of the attitude indicator toward hunting ($\beta = 0.45$; $p < 0.001$).

H2 was therefore supported – individuals with active hunters in their environment demonstrate higher acceptance of hunting compared to other groups.

H3 assumed that men exhibit higher levels of acceptance of hunting than women. This assumption is based on both literature reports and previous research results indicating a significant impact of gender on attitudes toward environmental management practices.

To verify this hypothesis, an analysis of differences between gender groups was conducted. The results are presented in Table 3.

Table 3. Analysis of differences in attitudes toward hunting by gender

Gender	N	Mean attitude indicator	Standard deviation
Female	408	2.80	0.84
Male	92	3.18	0.80

Source: own study.

An independent samples t-test showed that the difference between groups was statistically significant ($t = 3.85$; $p < 0.001$).

It is noteworthy that in the analyzed sample, women constituted almost four times as many participants as men (408 vs. 92). This pronounced disproportion in group sizes may influence the stability of the obtained results and their interpretation, particularly with respect to the representativeness of the sample. Nevertheless, based on the findings, H3 was positively verified – men exhibit significantly higher acceptance of hunting than women. Thus, gender proved to be an important factor differentiating attitudes toward hunting in the studied sample.

H4 posited that individuals following a meat-free diet exhibit lower levels of acceptance of hunting compared to those who do not follow such a diet. This assumption is supported by numerous studies suggesting that dietary choices may reflect deeper ethical and philosophical attitudes toward animals and the natural environment.

To test this hypothesis, an analysis of differences between groups was conducted. The results are presented in Table 4.

Table 4. Analysis of group differences in hunting acceptance

Meat-free diet	N	Mean attitude indicator	Standard deviation
No	435	2.97	0.84
Yes	65	2.22	0.82

Source: own study.

An independent samples t-test showed that the difference between groups was statistically significant ($t = 6.32$; $p < 0.001$).

The results confirmed H4 – individuals following a meat-free diet demonstrate significantly lower acceptance of hunting compared to those with a traditional diet. It should be noted, however, that the group following a meat-free diet was more than six times smaller than the group not following such a diet, which may affect the accuracy and interpretation of the estimates.

H5 stated: A higher level of acceptance of hunting is significantly associated with the combination of three factors: being male, not following a meat-free diet, and having hunters in one's environment.

To verify this hypothesis, a multiple regression model was employed, with the attitude indicator toward hunting as the dependent variable, and gender, meat-free diet, contact with hunting in the environment, ecological knowledge, and education as predictors.

The regression model was statistically significant ($F = 22.6$; $p < 0.001$) and explained as much as 34% of the variance in the attitude indicator toward hunting ($R^2 = 0.34$).

Table 5 presents the key regression results.

Table 5. Results of the regression analysis

Predictor	β	SE	p-value
Intercept	1.15	0.21	<0.001
Gender (male)	0.29	0.07	<0.001
Meat-free diet (yes)	–0.48	0.10	<0.001
Acquaintance with hunters (current)	0.57	0.09	<0.001
Higher education	0.18	0.07	0.014
Mean ecological knowledge	0.09	0.05	0.081

Source: own study.

The regression results indicate that the highest acceptance of hunting is exhibited by individuals who are male, do not follow a meat-free diet, have active hunters in their environment, and possess higher education. The level of ecological knowledge proved to be a positive factor, although its effect was not statistically significant after controlling for the other predictors.

It is noteworthy that this model, uniquely among those analyzed, explained more than 30% of the variance in attitudes toward hunting. This underscores the key role of socio-demographic factors and close contact with hunting in shaping acceptance of this practice.

CONCLUSIONS

The aim of the conducted study was to analyze the relationship between the level of ecological knowledge and the acceptance of hunting, taking into account selected socio-demographic factors. The results confirmed that attitudes toward hunting are complex and influenced by a variety of both individual and social factors.

Verification of H1 showed that the level of ecological knowledge was not a significant predictor of acceptance of hunting in the studied sample, and the variance in attitudes explained by this factor was very low. In contrast, both contact with hunting in one's environment (H2), respondent gender (H3), and adherence to a meat-free diet (H4) were significantly associated with the level of acceptance of hunting. In particular, individuals who had active hunters in their environment and men demonstrated higher acceptance of hunting, while those following a meat-free diet showed lower acceptance.

The highest explanatory power was obtained in the multiple regression model, which included socio-demographic factors, ecological knowledge, and contact with hunting. This model explained as much as 34% of the variance in attitudes toward hunting, confirming that acceptance of this practice results from a combination of complex social determinants, personal experiences, and worldview values.

The findings indicate that attempts to shape attitudes toward hunting solely through ecological education may be insufficient. Identity-related, social, and cultural factors also play a crucial role in forming views on hunting and wildlife management.

The limitations of this study are primarily related to unequal group sizes (e.g., a significantly larger number of women than men) and the use of the CAWI method, which may have influenced the sample composition. Further research is recommended using more representative samples and in-depth qualitative analyses, which would allow for a better understanding of the mechanisms shaping attitudes toward hunting.

In summary, the acceptance of hunting in society depends not only on the level of ecological knowledge, but also on social contacts, identity, and the worldview of respondents. These results should be taken into account when planning educational and management policies related to hunting and wildlife conservation in Poland.

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PREFERENCES OF THE SELECTED GROUP OF CONSUMERS TOWARDS NON-ALCOHOLIC BEERS

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Abstract

Non-Alcoholic Beers (NABs) have been growing in popularity and consumer interest in recent years. Although the NAB segment in Poland is growing, few studies have focused on the issue of observed consumer trends in the market for these products. Therefore, the aim of the study was to identify consumer preferences towards NABs. In order to achieve the aim of the study, desk research and a survey using the CAWI method were carried out. A non-probabilistic, purposive selection using the snowball method was applied, and the group of respondents consisted of adult consumers of NABs. The results indicate, among other things, that the most popular brands among consumers are NABs belonging to the largest brewing concerns in Poland. The consumers most prefer flavored NABs, they indicate citrus fruit as their favorite additives. By identifying consumer preferences, the product can be better tailored to meet buyers' expectations. This is important because an increase in popularity and consumption of NABs has the potential to reduce alcohol consumption. However, only if applied on the condition that the mentioned above products are consumed as substitutes for beverages with a higher alcohol content rather than as products to be consumed on additional occasions but drawing solid conclusions in this regard requires further extended research.

Keywords: non-alcoholic beers (NABs), consumer preferences, non-alcoholic equivalents of alcoholic beverages.

INTRODUCTION

In recent years, non-alcoholic equivalents of alcoholic beverages[1] have become increasingly popular among consumers. Non-alcoholic beers are the most popular and available on the Polish market [Jackowski & Trusek 2018]. Poland ranks fourth among EU countries in terms of the volume of non-alcoholic beer sold [Kokole et al. 2022]. Year by year, the non-alcoholic beer segment is becoming more and more popular. Currently, the beer market offers not only 0% lager and 0% flavored beers, but also beer specialties such as non-alcoholic wheat beers, APA (American Pale Ale) or IPA (Indian Pale Ale) style beers [Stachowiak & Bukowski 2021]. Although the non-alcoholic beer segment in Poland is growing, few studies have focused on the issue of observed consumer trends in the market for these products. By identifying consumer preferences, the product and assortment can be better aligned with buyers' expectations. In addition, a number of authors [Anderson et al. 2021a; Katainen et al. 2023; Kokole et al. 2022] points to the need to expand scientific research on non-alcoholic alcoholic beverage equivalents in view of the fact that the increase in their popularity and consumption has the potential to reduce alcohol use, but only if they are consumed as substitutes for higher alcoholic beverages and not as products to be consumed on additional occasions. However, drawing solid conclusions in this regard requires further extended research [Vasiljevic et al. 2018]. Anderson [2021a] identifies, among other things, research on individual consumer perceptions and preferences as research areas that need to be deepened.

Therefore, the aim of the study was to identify consumer preferences towards non-alcoholic beers. The main focus of the study was on identifying favorite brands, types of non-alcoholic beers, flavorings, as well as the preferred type of packaging and its capacity.

[1] In the current legal state in Poland, according to the Act on Upbringing in Sobriety and Counteracting Alcoholism, a beverage containing up to 0.5% alcohol by volume is considered to be the non-alcoholic equivalent of an alcoholic beverage. In relation to this definition, non-alcoholic beverages are both products that are completely devoid of alcohol, i.e., 0.0%, as well as those containing it in small amounts (up to 0.5% alcohol by volume) [Kamińska & Dmowski, 2023].

1. NON-ALCOHOLIC BEERS – MARKET AND CONSUMER TRENDS

The market for non-alcoholic beers has been growing rapidly over the past decade. In the European Union countries and the UK, between 2013 and 2019, the volume of non-alcoholic beers sold increased from 0.59 to 1.38 billion litres and the value from €0.42 to €1.28 billion. In 2019, non-alcoholic beer accounted for 3.8% of beer volume, with five countries responsible for 80.8% of this volume: Germany (30.5%), the Netherlands (14.4%), Spain (16.8%), the Czech Republic (7.1%), and Poland (12%) [Kokole 2022].

Analysing foreign trade in turn, Poland is among the top ten countries in terms of exporting these products worldwide. In 2023 Poland was ranked 8th in terms of the value of non-alcoholic beer exports, with a result of USD 23.7 million behind the Netherlands (USD 185 million), Germany (USD 95.9 million), Belgium (USD 68.8 million), the UK (USD 33.6 million), France (USD 30.8 million), Ireland (USD 27.5 million) and Spain (USD 26 million). In 2022, on the other hand, Poland was just behind the podium, taking fourth place in terms of the value of non-alcoholic beer exports with USD 36.1 million, just behind the Netherlands (USD 166 million), Germany (USD 96.6 million) and Belgium (USD 44.4 million) [OEC 2025]. Figure 1 shows the value of Polish non-alcoholic beer exports in 2018–2023 and the percentage of Polish exports of these products in global exports.

However, it is worth noting that in Poland the non-alcoholic beer segment only developed after 2016 [ZPPP – Browary Polskie 2022]. In 2017, there was a significant increase of 22% in value terms for the segment of these products [Fal 2020; Fal 2023], and another significant increase took place in 2018 (80% growth in value and 85% growth in volume of non-alcoholic beer sales). As a result, the non-alcoholic beer segment has been increasing its share of the total beer market for several years. In 2017, the value share of these products was only 1.9%, in 2020 – 5.6%, and in 2024 already 7.5% [ZPPP – Browary Polskie 2022; ZPPP – Browary Polskie 2025]. As indicated by representatives of the beer industry, their ambition is for the share of non-alcoholic beers in the Polish beer market to increase to more than 20% by value in the future [Supernak 2025].

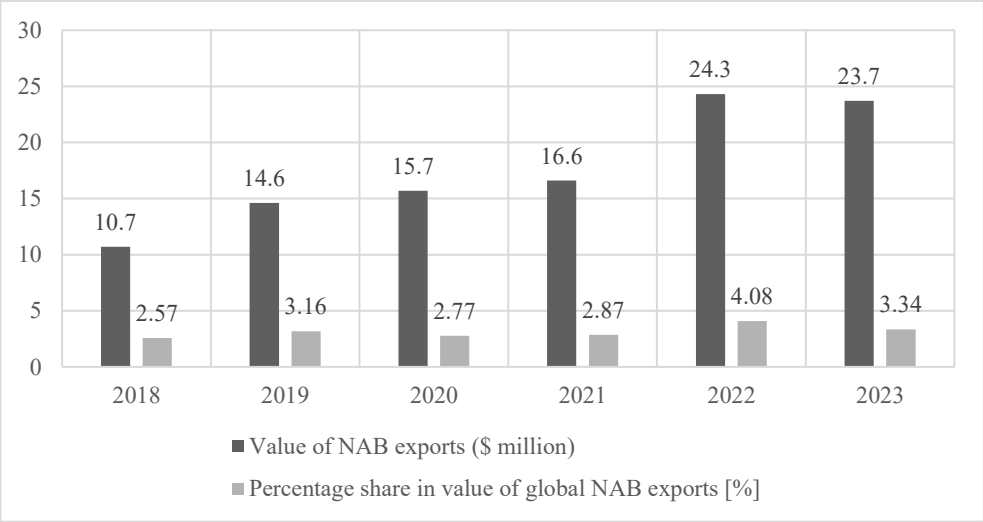


Figure 1. Data on the value of Polish non-alcoholic beer exports between 2018 and 2023 and the percentage of Polish exports of these products in global exports

Source: OEC 2025.

Such dynamic growth of the non-alcoholic beer segment is a response to long-term health trends and changing consumer expectations and preferences. Conscious consumers with a healthy lifestyle often avoid alcohol in their diet, due to the fact that it damages health and is high in calories. This approach is in line with the recent dominant consumer trend in the global food market to seek out products referred to as BFY [Cardello et al. 2013; Interfood 2023; Brownbill et al. 2018; ZPPP – Browary Polskie 2022]. Currently, so-called 'no-, low-' calorie foods and beverages, traditional products packaged in smaller portions and foods generally considered healthy are considered BFY products in the category of CPG goods (consumer packaged foods) (Hudson Institute). In the case of alcoholic beverages, BFY products are considered to reduce alcohol consumption and reduce calorie intake [ZPPP – Browary Polskie 2022]. That the increasing popularity of non-alcoholic beers may be due to more responsible consumer attitudes towards alcohol is evidenced, among others, by the findings of Silva et al. [2016], who indicated that health and wellbeing issues may influence the choice of zero and low alcohol beers. Similar conclusions have also been reached by other authors, who indicate that the choice of reduced alcohol beers is primarily motivated by taste, health issues and

weight control (lower calorie content) [Chrysochou 2014; Anderson et al. 2021b]. In addition to the aforementioned motives for choosing non-alcoholic products, it is also important to find out consumers' preferences for these products, as this allows the product and assortment to be better tailored to buyers' expectations. This is important because the increase in popularity and consumption of non-alcoholic beers has the potential to reduce alcohol consumption, but only if they are consumed as substitutes for higher alcoholic beverages and not as products to be consumed on additional occasions. However, drawing solid conclusions in this regard requires further extended research [Vasiljevic et al. 2018].

2. RESEARCH METHODOLOGY

Research methods such as desk research and the CAWI method were used in this study to achieve the stated objective.

In the first stage of the research, the current state of knowledge was verified by conducting an analysis of found data, as well as a cross-sectional analysis and comparison of historical data using the desk research method [Bednarowska 2015]. The focus was mainly on the topic of non-alcoholic beers, including in particular issues such as the market for these products and observed consumer trends.

In the second stage, using the CAWI (Computer-Assisted Web Interview) method conducted a consumer survey using a proprietary survey questionnaire as the research tool. The survey questionnaire consisted of particulars and a set of closed questions on preferences towards non-alcoholic beers, including favorite brands, types of beers, flavorings, as well as preferred type of packaging and capacity. The data were collected using an online panel, a questionnaire construction tool provided as part of the Google Forms platform. The CAWI method used in the study consists of computer-assisted marketing research using the Internet. This method allows for high penetration in the population segment of interest – especially in groups where Internet use is the primary tool for work (Generation Y, Z) [Malinowski 2012].

In this study, respondents selected for the survey using non-probabilistic sampling were the subjects of the research. Purposive selection using the snowball method was used and the sample structure was based on the characteristics of people who are adult consumers of non-alcoholic beers living throughout Poland.

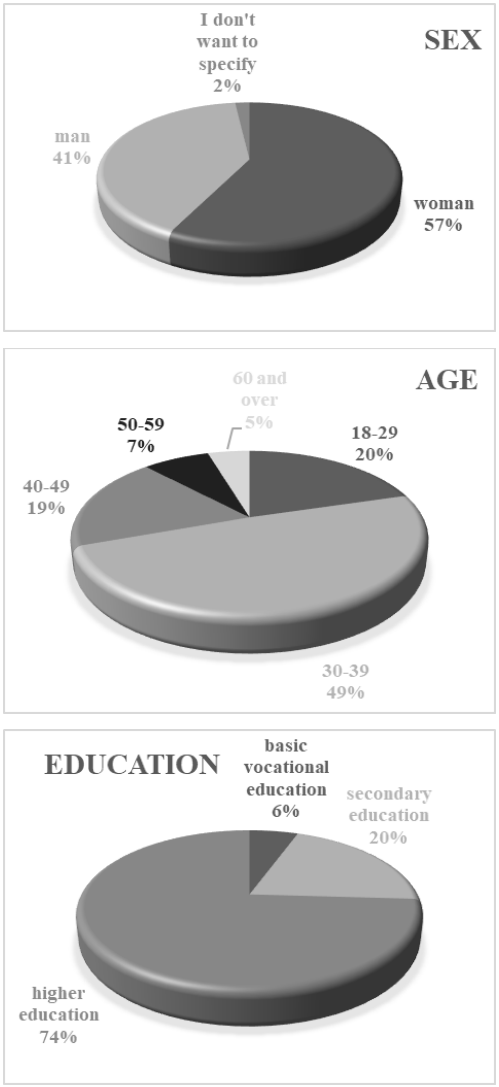


Figure 2. Demographic characteristics of respondents whose responses were included in the analysis

Source: own study.

A total of 140 people took part in the survey, but answers from respondents who incorrectly completed the attention verification question (n = 21; 15%) and questionnaires that were completed in error (n = 11; 8%) were discarded. Ultimately,

108 answers were considered for analysis. The characteristics of the respondents whose answers were included in the analysis can be found in Figure 2.

The survey sample was not representative, with the majority of respondents being female (n = 62; 57%), aged 30-39 (n = 53; 49%), 18-29 (n = 22; 20%) and 40–49 (n = 20, 19%), and respondents with tertiary (n = 80; 74%) and secondary education (n = 22, 20%).

3. RESULTS AND DISCUSSION

Table 1 shows a summary of the favorite brands of non-alcoholic beers is provided, along with an indication of the percentage of indications for each brand.

Table 1. A summary of favorite brands of non-alcoholic beers, together with the percentage of indications for each brand

No.	Brand	Percentage of consumer indications [%]	No.	Brand	Percentage of consumer indications [%]
1.	Lech	31	16.	Žatecký	6
2.	Somersby	24	17.	Miłosław	6
3.	Żywiec	19	18.	Garage	3
4.	Karmi	19	19.	Carlsberg	2
5.	Desperados	16	20.	Fortuna	2
6.	Okocim	16	21.	Kormoran	2
7.	Warka	15	22.	Amber	2
8.	Heineken	12	23.	Peroni	1
9.	Tyskie	9	24.	Pinta	1
10.	Książęce	8	25.	Bavaria	1
11.	Corona	7	26.	Grodziskie	1
12.	Kozel	7	27.	Bitburger	1
13.	Łomża	7	28.	Raciborskie	1
14.	Perła	7	29.	Perlenbacher	1
15.	Hardmade	6	–		

Source: own study.

Among the consumers surveyed, Lech is the most popular brand of non-alcoholic beer (31%), followed by Somersby, Żywiec, and Karmi (19%). It is worth mentioning at this point that the above-mentioned beer brands belong to the three largest brewing concerns in Poland, i.e., Kompania Piwowarska, Carlsberg Polska and the Żywiec Group. The aforementioned concerns account for the majority (almost 80%) of the beer market in Poland (taking into account production sold in hectolitres [Klimkiewicz et al. 2021].

Other brands of the aforementioned brewing concerns are also popular with consumers. In the case of the Żywiec Group, other beer brands received 16% (Desperados), 15% (Warka), 12% (Heineken) of respondents' indications respectively, while Kompania Piwowarska's brands: 9% (Tyskie), 8% (Książęce), 7% (Kozel), 6% (Hardmade), while Carlsberg Polska brands received 16% (Okocim), 6% (Žatecký). Other beer brands chosen by around 6–7% of respondents include Corona, which is produced by Mexican company Grupo Modelo, and Łomża, which belongs to the Van Pur Group, as well as the Perła brand (Browary Lubelskie) and Miłosław (Browar Fortuna).

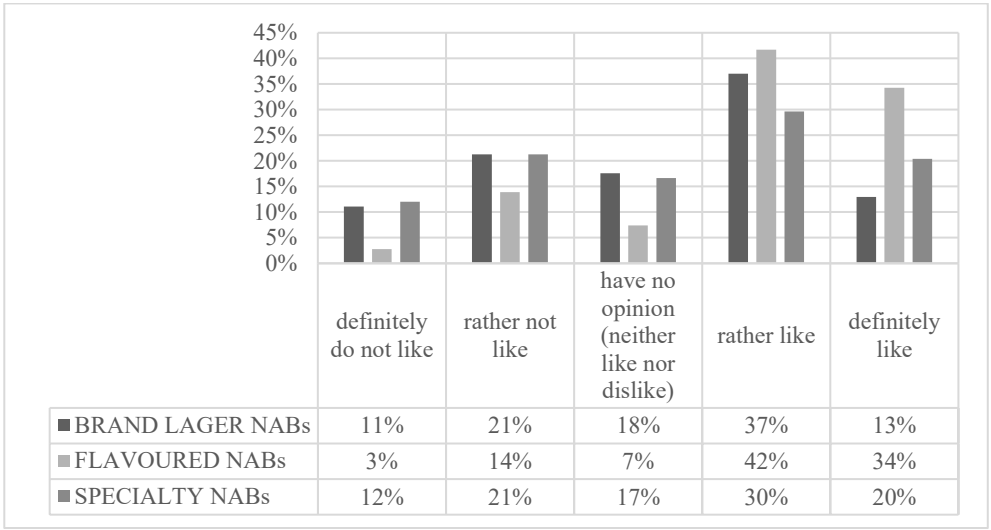
Based on the data in Table 1, it can be concluded that the beers of the largest brewing concerns are far more popular among consumers than those of small or medium-sized breweries, as well as brands of imported beers from other countries such as Bavaria or, for example, Bitburger.

In terms of gender variation in brand preference, women's favorite non--alcoholic beer brands are: Somersby (35%), Lech (31%), Desperados (23%), Karmi (21%), Okocim (19%), and Żywiec (19%). These results partly coincide with the data obtained by Kantar in 2022 [Statista 2022a], where the Somersby brand was also in first place (29%), followed by Lech (21%), but the next places in this ranking differed from and were as follows: Warka – 20%, Karmi – 12%, Żywiec – 8%, Okocim – 7%, Heineken – 6%. Based on the results, it can be concluded that women most prefer beer brands that are mainly associated with non-alcoholic flavored beers, i.e., Somersby or Desperados.

In turn, men's favorite brands of non-alcoholic beers are: Lech (32%), Heineken (20%), Warka (20%), Żywiec (20%), Karmi (16%), Perła (16%), Kozel (14%), Książęce (14%), and Tyskie (14%). The data obtained in this study overlaps to some extent with the results obtained by Kantar in 2022 [Statista 2022b], where men most preferred the following brands of non-alcoholic beers: Lech (20%), Tyskie (13%), Żywiec (13%), Somersby (12%), Warka (12%), Heineken (12%), Łomża (6%), and

Karmi (6%). In the case of men's preferences, it can be noted that they have a greater preference for beer brands associated with non-alcoholic light lager beers, i.e., Heineken, Żywiec, Tyskie, as well as brands that have so-called non-alcoholic beer specialties in their range, e.g., Kozel, Książęce.

The graph in Figure 3 shows the degree to which consumers like the different types of non-alcoholic beers is presented.



	definitely do not like	rather not like	have no opinion (neither like nor dislike)	rather like	definitely like
BRAND LAGER NABs	11%	21%	18%	37%	13%
FLAVOURED NABs	3%	14%	7%	42%	34%
SPECIALTY NABs	12%	21%	17%	30%	20%

Figure 3. The degree to which consumers like the different types of non-alcoholic beers

Source: own study.

As can be seen in Figure 3, the most popular type of non-alcoholic beer is flavored beers. 34% of respondents indicated that they definitely liked them and 42% that they rather liked them. Only 3% of consumers strongly dislike non-alcoholic flavored beers and 7% have no opinion on the matter. Less favored than the flavored beers mentioned above are non-alcoholic lagers (15% of respondents definitely like them, 37% rather like them) and beer specialties (20% of consumers definitely like them and 30% rather like them), while 11–12% of consumers definitely dislike these types of non-alcoholic beers, some 17–18% have no opinion in this regard. The greater popularity of non-alcoholic flavored beers may be due, among other things, to the structure of the market. According to data in the Kompania Piwowarska Report [2020], flavored beers accounted for the majority of the non-alcoholic beer

market, i.e., around 62–64%, in 2019–2020. Also, a study by Gliszczyńska-Świgło et al. [2025] confirmed that non-alcoholic flavored beers are the most preferred type of non-alcoholic beers by consumers, with 66% of consumers surveyed indicating this type as their favorite.

Given the popularity of flavored beers among the non-alcoholic beer category, Table 2 presents the preferred flavor additives for non-alcoholic flavored beers, together with the percentage of consumers' indications for each additive.

Table 2. Preferred flavor additives for non-alcoholic flavored beers along with the percentage of consumer indications for each additive

No.	Flavor additive	Percentage of consumer indications [%]	No.	Flavor additive	Percentage of consumer indications [%]
1.	lemon	40	19.	kumquat	3
2.	lime	23	20.	plum	3
3.	grapefruit	19	21.	guava	2
4.	raspberry	18	22.	blueberry	2
5.	cherry	16	23.	pear	2
6.	passion fruit	15	24.	bilberry	2
7.	mango	14	25.	dragon fruit	2
8.	watermelon	13	26.	blackberry	1
9.	mint	13	27.	lychee	1
10.	apple	10	28.	mandarin	1
11.	orange	10	29.	melon	1
12.	pomegranate	8	30.	quince	1
13.	cranberry	6	31.	rhubarb	1
14.	pineapple	6	32.	grapes	1
15.	blackcurrant	5	33.	pine shoots	1
16.	strawberry	4	34.	rice	1
17.	peach	3	35.	elderberry	1
18.	kiwi	3			

Source: own study.

As indicated in Table 2 the favorite additives to non-alcoholic flavored beers are selected citrus fruit additives, such as lemon (40%), lime (23%) or grapefruit (19%). Also, popular flavor additives to beers are raspberry (18%), cherry (16%), passion fruit (15%), mango (14%), watermelon (13%), mint (13%), apple (10%) and orange (10%). The other flavorings included in Table 2 were indicated by less than 10% of respondents.

The study also analyzed preferences for favorite types of non-alcoholic beers defined as beer specialties (Figure 4).

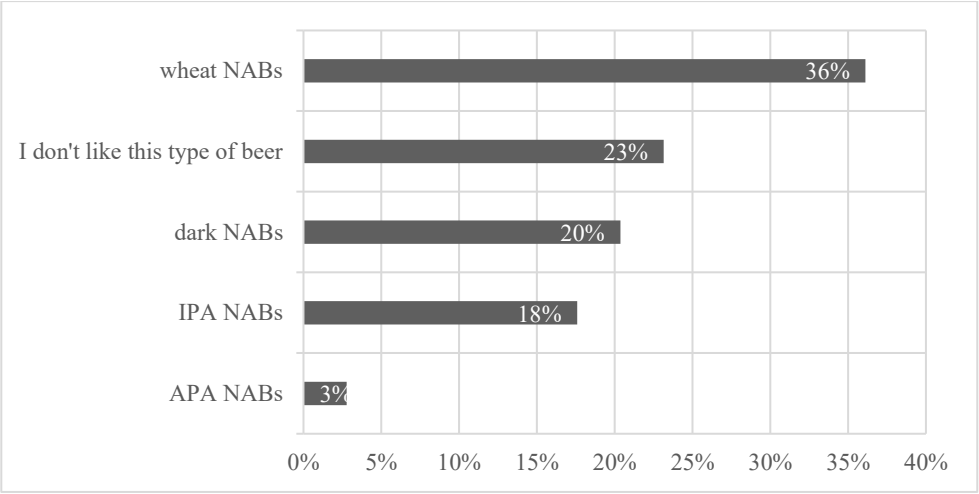


Figure 4. Preferences for favorite non-alcoholic beers described as beer specialties

Source: own study.

The research shows that of the types of beers described as beer specialties; wheat beers are the most preferred by consumers (36%). In contrast, 20% of the respondents surveyed consider dark beers as their favorite type of beer speciality and 18% consider IPA beers. Only 3% of respondents indicated the APA type as their favorite type of beer speciality, while almost ¼ of respondents indicate that they do not like this type of non-alcoholic beer.

Respondents were also asked about their preferred type and size of non-alcoholic beer packaging. The detailed results of the analyses are shown in Figure 5.

The vast majority of consumers surveyed prefer the glass bottle of non-alcoholic beer (74%), but 20% of consumers surveyed believe that the type of packaging does

not matter to them. In terms of preferred capacity, on the other hand, the largest number of respondents (38%) indicated 330 ml, but slightly fewer, 34%, prefer 500 ml. For less than one-third of the consumers surveyed, the volume of the beer package does not matter. Also, in the case of alcoholic beers – as Jąder [2013] points out – the glass bottle is preferred (90%), but in the case of beers with an alcohol content, the smaller volume i.e. 330 ml is much less acceptable to consumers (11%). However, it is worth pointing out that the group studied by Jąder [2013] was only young consumers, i.e., students.

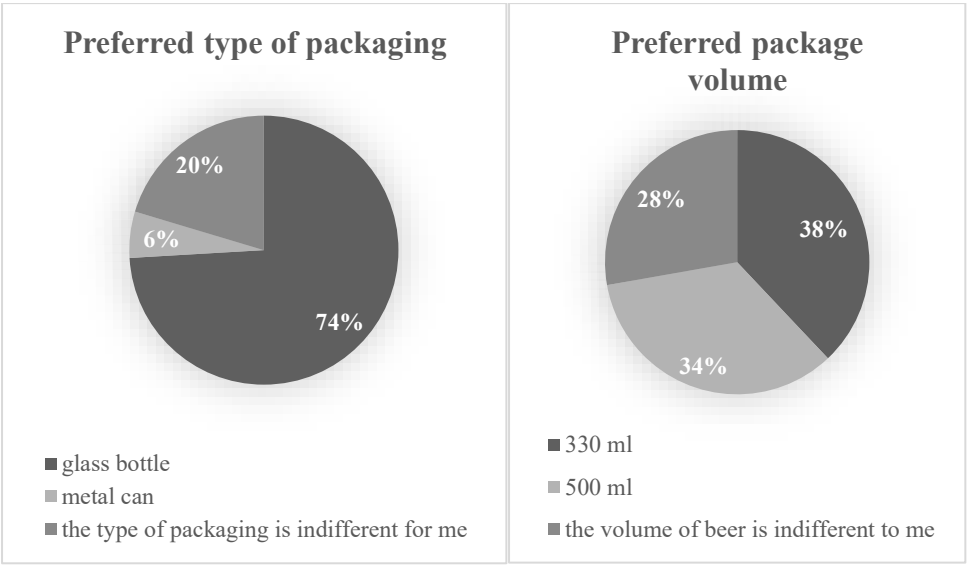


Figure 5. Preferred type and size of non-alcoholic beer packaging according to consumers surveyed

Source: own study.

It should be noted that by identifying consumer preferences, the product and assortment can be better aligned with buyers' expectations. Furthermore, knowledge of consumer preferences helps producers and distributors – through an appropriate marketing strategy – to be more in tune with the market environment. This is because a central tenet of effective management is the incorporation of customer orientation into a company's organizational culture, so that the organization creates a foundation on which it can build a sustainable competitive advantage [Huczek 2013]. This is

particularly important in the context of new and emerging market segments, where understanding the needs of potential customers can determine the success of an organization. One such market with great potential for growth, both in Poland and internationally, is the market for non-alcoholic equivalents of alcoholic beverages. It is also worth mentioning that, although non-alcoholic beers are the most popular and readily available on the Polish market, a wide range of non-alcoholic wines are also currently on sale, and products alluding to the names of spirits such as whisky, gin, rum or vodka have recently appeared on shop shelves [Kamińska et al. 2024]. Conducting research into observed consumer trends in the market for these products is important, as the increase in popularity and consumption of alcoholic beverage substitutes has the potential to reduce alcohol consumption, but only if they are consumed as substitutes for higher alcoholic beverages and not as products to be consumed on additional occasions [Anderson et al. 2021a; Katainen et al. 2023; Kokole et al. 2022]. However, drawing reliable conclusions in this respect requires further extended research, although, as indicated by President of the Board of the Polish Public Health Association, the increasing willingness of consumers to choose 0% products is a desirable market development from the point of view of remodelling alcohol consumption in Poland [Fal 2020].

CONCLUSIONS

The study addresses consumer preferences for non-alcoholic beers, including the identification of favorite brands, types of beers, flavorings, as well as preferred packaging type and capacity. The results indicate that among the surveyed group of consumers, the most popular non-alcoholic beer brands are those belonging to the largest beer concerns in Poland. Women most prefer beer brands that are mainly associated with non-alcoholic flavored beers, while men have a greater preference for beer brands associated with non-alcoholic light lager beers, as well as brands that have so-called non-alcoholic beer specialties in their range. The research also shows that consumers like non-alcoholic flavored beers the most, with citrus fruits cited as their favorite additives. In contrast, among the type of beers described as beer specialties, wheat beers are the most preferred by consumers. When considering the packaging of non-alcoholic beers, the 330 ml glass bottle is preferred by the largest group of respondents. Knowing consumer preferences is important because it helps

producers and distributors to prepare an appropriate marketing strategy that allows them to be more in tune with the market environment. By identifying consumer preferences, the product and assortment can be better aligned with buyers' expectations. Furthermore, conducting research and analysis in this area is important, as the increase in popularity and consumption of non-alcoholic beers has the potential to reduce alcohol consumption, but only if they are consumed as substitutes for higher alcoholic beverages and not as products to be consumed on additional occasions. However, drawing solid conclusions in this regard requires further extended research.

Therefore, it can be concluded that the issues presented in the study are very topical and developing. The authors believe that this study can contribute to further discussion and research into consumer preferences and expectations towards non-alcoholic beers, as well as other non-alcoholic counterparts to alcoholic beverages that are increasingly available on the market such as non-alcoholic wines or substitutes for spirits such as gin, whisky, or rum.

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ANALYSIS OF THE NEW CARE OFFER AND PREFERENCES OF BEAUTY SALONS CUSTOMERS

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Abstract

The aim of the work was to analyze the market of cosmetic services with particular emphasis on new care treatments, their conditions, applications, and development prospects. The development of the cosmetic market and the use of innovative cosmetic devices were analyzed. The research was conducted in medium-sized beauty salons in Buk and Poznan, which offered similar services.

For several years now, the most frequently chosen service in beauty salons has been skin care treatments, which help to eliminate skin imperfections, achieve radiant skin, and improve figure.

In order to assess consumer behavior on the cosmetic services market and their attitude towards treatment innovations, research was conducted using proprietary surveys. The answers obtained on their basis (48 people took part in the study) allowed for an assessment of consumer preferences and an outline of future possibilities for the development of this type of service.

Keywords: cosmetic market, care treatments, treatment technologies, consumer preferences.

INTRODUCTION

According to the GFK Beauty Report from 2016, Polish consumers spend 5 hours a week on beauty and physical attractiveness – less than an hour more than the global average. According to the research, 44% of Poles want to look better, and

35% of respondents believe that appearance reflects well-being, and this issue can be classified as a consumer's mental well-being, which is closely related to maintaining health [www.gfk.com].

The modern canon of beauty quite clearly imposes the requirements of a perfect appearance, which is why, unfortunately, skin imperfections are considered complexes, and striving for the ideal becomes a daily struggle. However, the desire to achieve a beautiful appearance is often associated with striving to achieve a higher social status.

People who want to change their appearance are divided into three groups: healthy people who care about their appearance, people with skin problems, and people addicted to care or aesthetic treatments [Kołodziejczak 2020]. The offer of beauty salons has appeared treatments that help to eliminate skin imperfections, achieve radiant skin, and improve the figure. The most frequently proposed aesthetic medicine treatments chosen by women are treatments using hyaluronic acid and botulinum toxin type A, while in the case of men the most frequently chosen treatment is laser closure of vessels on the nose [Stachowiak-Krzyżan & Gogołek 2019]. Chemical peelings and needle mesotherapy are becoming increasingly popular, and when asked about the main reason for using aesthetic cosmetology services, the answer is – visible rejuvenation of appearance [Biernat & Żukowska 2024].

The psychology of sales in a beauty salon is mainly based on understanding what motivates customers to choose specific services. Listening to the customer and recognizing their needs is the key to effective sales. Understanding the target group of consumers is crucial because it allows you to learn about their needs and expectations, and therefore, adapt the offer of services accordingly [Wiewiórska 2024]. Currently, you can see an increase in the number of salon accounts on social media due to quick access to potential customers and easy advertising of their services, thanks to shared photos or videos. Social media is guided by its own rules, so it is important to create your own community that will engage under posts on the Internet, i.e., like, comment and share among your group of friends.

Live advice, i.e., starting a broadcast from your office and answering questions, has gained huge popularity. This form of communication gives you a greater opportunity to present yourself as an expert in a given field. Establishing constant contact with recipients in the form of video or photos provides the basis for the credibility of the office and thus encourages them to familiarize themselves with the

offer. In order to understand the developing industry, understanding consumer perception is essential to maintaining the quality of the services provided [Akter 2008]. Promotions and special offers are an effective way to attract new customers and encourage current ones to return. Offices can offer discounts on the first visit, discounts for regular customers or service packages. Promotions should be attractive and properly promoted, both in social media and through other communication channels such as e-mail or leaflets, i.e., the use of marketing mix tools, focusing on reaching potential customers using traditional and modern media sources [Tkaczyk 2021].

The growing trend of cosmetic treatments and aesthetic medicine is caused by the dynamic lifestyle of mainly women, who cannot afford a long convalescence at home [Wasiluk 2016]. In response to consumer expectations, the High Intensity Focused Ultrasounds technology has been introduced. The technology has been known for less than 20 years. This treatment is exceptionally popular due to its non--invasiveness, no convalescence period and low chance of post-treatment complications [Theodorou et al. 2021]. In 2017, the HIFEM – High-Intensity Focused Electromagnetic Field technology appeared on the Polish market. It has found its application in body contouring and the treatment of incontinence. Another interesting treatment is laser peeling using a thulium laser with a wavelength of 1927 nm. It is characterized by much less pain in contrast to fractional ablative lasers and a much shorter recovery time [Wilczyński 2017].

In beauty salons, cooperation is increasingly established between cosmetologists and manufacturers of cosmetic devices and products. Thanks to a holistic approach to customers, as well as the desire to meet their expectations, the cosmetics industry has gained new opportunities for cooperation with companies promoting natural body cosmetics or dietary supplements [Naszyńska 2022].

More than fifteen years ago, the most frequently performed treatments in the field of cosmetology and aesthetic medicine included the following services: face and body lifting, wrinkle removal, injection lipolysis, lip augmentation, mesotherapy, treatment of excessive sweating and removal of discoloration [Sztorc 2008]. Now the cosmetic services market offers many therapies that allow for improving the appearance and well-being of customers.

The study presents a new offer proposed by specialized beauty salons and an attempt is made to assess the approach of customers to innovative proposals of this industry.

The aim of the study was to review new, available treatment methods offered to clients of standard beauty salons and to identify the behaviors and attitudes of consumers on the cosmetic services market towards treatment innovations. The study was preliminary in nature, aimed at identifying trends and behaviors, not establishing formal statistical relationships.

1. TREATMENTS USING MODERN TECHNOLOGIES

Currently, treatment technologies in beauty salons play a key role in providing effective and innovative care services. Their growing popularity results from the increased interest of clients in improving the condition of the skin or combating visible signs of aging. The versatility of treatment technologies allows for the performance of diverse services, including laser therapy, ultrasound, light therapy and microneedling. True innovations are constantly revolutionizing the development of many industrial sectors and at the same time influencing society, thanks to which beauty salons can offer comprehensive care, which includes a wide range of services that help to eliminate skin problems of consumers.

The introduction of modern technologies to cosmetology practice brings numerous benefits to both clients and specialists. Innovative treatment solutions are an integral part of modern cosmetology, providing clients with the possibility of effectively improving the condition of their skin with minimal discomfort and the risk of post-treatment complications, but with a greater financial outlay.

Technological development, which constantly introduces new innovations to the field of modern treatments, is also important. Continuous improvement of existing devices and introduction of new solutions to the market contributes to the improvement of the effectiveness of treatments and to the increase of their comfort for clients and cosmetologists. The development prospects in this field are promising and indicate a further increase in the popularity of treatment technologies in the future.

Information on treatment technologies was obtained courtesy of the company M'onduniq Cosmetiques Professionnel, which produces high-quality organic cosmetics and professional cosmetic products, including treatment devices [monduniq.pl]. The brand maintains the highest standards in accordance with ISO

22716, and the raw materials used during production are subject to ECOCERT, ECOCERT Greenlife and Qualité France certification.

Modern cosmetology and aesthetic medicine constantly show the dynamics of development of treatment services. By establishing cooperation with manufacturing companies, many beauty salons can help their clients with even the most difficult skin problems. Within the classification, treatments can be categorized as those performed on the face and those performed on other parts of the body.

Technologies influence the development of new methods of treatment and therapy. In the field of aesthetic cosmetology and dermatology, innovative techniques are being introduced, such as lasers, ultrasound or radiofrequency, which offer effective and safe solutions for various skin problems. The methods described below are just such techniques. The discussed treatments are a relatively new, analogous offer offered to clients by two beauty salons selected for the study.

Thanks to the willingness to help and materials provided by the owner of a friendly beauty salon, treatments using modern cosmetic technologies were described in detail [materials regarding the use of professional equipment, customer opinions, survey questionnaire, data collected April-May 2024].

1.1. Hydrogen purification

This treatment focuses on the use of active hydrogen, which reduces the excess of free radicals that lead to premature skin aging. Combined with hydrogen ions, water and oxygen are created, which help rejuvenate, nourish, and lift the facial skin.

The device uses water saturated with hydrogen under high pressure, then pumped and drained into the skin. The skin is cleansed of dead skin cells, impurities, sebaceous secretions, otherwise known as open comedones, and inflammation occurring on the face is alleviated.

Hydrogen purification is a treatment suitable for all skin types, even the most demanding ones (atopic, vascular, sensitive, with acne vulgaris or rosacea). It does not require prior preparation of the client before the treatment and is not invasive

The post-treatment effects are as follows:

- oxygenated skin and cleansed pores,
- soothe inflammation,
- even skin tone,
- improved skin elasticity,

- reduced discoloration,
- regulated sebum secretion,
- elimination of harmful free radicals,
- exfoliated dead skin layers.

The Aquametiq Hydra Prime device is equipped with eight treatment heads that help in working for individual skin needs. Ionic microcurrents introduce active ingredients contained in treatment cocktails into the deep layers of the skin. Additionally, the use of a head with a natural jadeite stone supports the rejuvenating, anti-wrinkle effect and improves circulation.

During the Beauty Forum Award Poland in 2021, this device won in the LNE 2020 innovation nomination. Developing beauty salons are eager to establish cooperation and introduce hydrogen purification treatment, using the device from M'onduniq, which has an even greater impact on the quality of the service and customer satisfaction.

1.2. Oxygen bioinfusion

Facial care using this treatment involves combining two technologies: injecting highly concentrated active ingredients into the deep layers of the skin and using heads that carry oxygen at various concentrations.

This treatment is designed for every client, regardless of age and skin problems. However, the greatest effects will be visible in people who struggle with dry, oxygen-deprived, irritated, and damaged skin, wrinkles, and discolorations, as well as acne and scars.

Oxygen bioinfusion is a suitable alternative to invasive and painful procedures. It is recommended to use this type of procedure in combined therapies after laser therapy or aesthetic medicine procedures.

The effects obtained after the procedure are:

- smooth, brightened, and rejuvenated skin,
- nourished and deeply moisturized complexion,
- improved firmness and elasticity,
- lifting of the face oval,
- reducing the visibility of wrinkles,
- lifting of the eye area,

- enhancing the lips,
- stimulating the production of collagen and natural skin regeneration processes,
- alleviating acne lesions.

The BioOxy Infusion method uses an innovative device that transfers valuable substances to the skin in a safe and painless way. Law Business Quality appreciated the oxygen bioinfusion technology and awarded the prize in the prestigious product of 2019 category.

1.3. Volumetiq lift

This is a groundbreaking rejuvenation treatment performed using the Volumetiq Lift device, which, based on nanocrystalline technology, allows you to achieve a lifting effect without undergoing invasive procedures. The treatment is based on the stimulation of collagen and elastin production by introducing concentrated active ingredients using a syringe.

This type of treatment uses 6 procedures, and each of them has a different action:

- nanocrystal pen micropeeling – thanks to microexfoliation technology, the skin is subjected to deep cleansing,
- nanocrystal pen fractional mesotherapy – allows for intensive injection of nutrients into the skin tissue,
- needle-free nanomesotherapy – deeply nourishes the skin thanks to microcurrents that flow only between two electrodes,
- nanocrystal bipolar radiofrequency – uses radio waves that affect collagen fibers and stimulate the production of new proteins,
- nanocrystalline cryotherapy – the treatment is based on lowering the temperature of the tissues, thanks to a head massage within the range of 5-10°C, which allows for the removal of swelling and a slimming effect,
- LED blue & green phototherapy – allows for an anti-inflammatory effect and helps get rid of skin imperfections.

The Volumetiq lift treatment provides the following effects:

- wrinkle reduction,
- firming and improving skin elasticity,
- lifting the face oval,

- rejuvenating and smoothing the skin,
- nourishing the deep layers of the skin and deep cleansing,
- improving skin tone,
- improving microcirculation.

1.4. Carbon peeling

This is a type of treatment during which the face is covered with a special, colloidal carbon suspension and irradiated with an IQ laser beam. Carbon particles absorb the energy of the laser light and penetrate the smallest skin irregularities, depressions, and pores during the process.

Carbon peeling can be performed at any age and is recommended for both women and men. The treatment is not painful, and the only sensation that accompanies it is heat.

This treatment is recommended for people struggling with dull and rough skin, enlarged pores, excessive seborrhea and acne, fine wrinkles, and signs of skin aging.

Carbon peeling is a treatment that brings many benefits to the skin. First of all, the complexion is deeply cleansed, which reduces the visibility of pores. The skin also becomes more uniform, which makes it look healthier and more radiant. Peeling also reduces inflammation and excessive sebum secretion. This treatment stimulates collagen production, which results in smooth and rejuvenated facial skin. After the therapy, it is advisable to strengthen the care in the form of using moisturizing creams, which additionally have a 30 SPF filter.

IQ Laser is the latest optical technology used in modern cosmetology and cosmetics. The device uses diode and picosecond lasers, and the combination of the two technologies allows cosmetologists to perform treatments such as laser epilation, tattoo, or permanent makeup removal, and even skin fractionation.

1.5. Microneedle Radiofrequency RF

This is an advanced and non-invasive cosmetic procedure that allows for skin revitalization by using radio frequency and heating the dermis to stimulate the natural production of collagen and elastin – proteins responsible for the skin's youthful appearance. During the procedure, delicate microneedles penetrate the epidermis, causing controlled tissue damage and reaching deeper layers of the skin.

Using this technique, it is possible to precisely regulate the depth and intensity of action, which reduces the risk of damage to the skin's surface and at the same time shortens the recovery time.

Microneedle Radiofrequency RF is recommended for people struggling with:

- stretch marks on the abdomen, breasts, thighs and back,
- flabby, jelly-like abdomen,
- acne scars, after cesarean section and other types,
- wrinkles around the eyes,
- skin porosity,
- uneven skin tone.

During the procedure, disposable cartridges of various types are used:

- 10-needle cartridges – thanks to them, the action of microneedle radiofrequency in various treatments is reliable and effective,
- 25-needle cartridges – allow simultaneous action in all layers of the skin, resulting in firmer and elastic skin. It is best used in lifting treatments and those removing acne scars,
- 64-needle cartridges – used in treatments reducing the visibility of scars, stretch marks and excessive sweating.

After the treatment, the process of new collagen formation takes place, shortening and thickening of its fibers and creating new bonds, the effects of which are:

- reduced acne scars and stretch marks,
- minimized visibility of the problem of excessive sweating,
- lifted and rejuvenated skin,
- eliminated dark circles and puffiness under the eyes,
- removed discolorations and skin spots.

1.6. Microneedle mesotherapy

It is one of the most popular treatments in professional beauty salons and aesthetic medicine, the main goal of which is to improve the condition of the skin, minimize the visibility of wrinkles, scars, and discolorations. The treatment combines needle mesotherapy and microneedle technology. In this case, the key difference between mesotherapy and microneedle radiofrequency RF is the use

of radio waves in the second method. The device used is the same as in the Volumetiq lift treatment.

Microneedle mesotherapy uses thin needles to introduce special active substances deep into the skin. This process increases the production of collagen and elastin. At the same time, the needles cause microscopic damage to the skin, activating natural regeneration processes, resulting in a smoother, firmer, and more radiant complexion.

It is possible to treat many skin problems such as discoloration, acne scars, stretch marks, laxity, loss of firmness or facial contour disorders. The procedure can be performed on the face, neck, décolleté, as well as on other parts of the body – arms, thighs, or abdomen.

The pain of the procedure depends on the depth of the needle puncture and the individual pain sensation of the client. Before starting this method, the specialist can apply a local anesthetic cream or gel, which makes the procedure almost painless.

After microneedle mesotherapy, it is important to follow a few rules in order to accelerate skin regeneration. First of all, for a few days after the procedure, you should not use any cosmetics, expose the treated body part to sunlight, and use a sauna or swimming pool. After the procedure, the convalescence is relatively short, usually lasting from 2 to 7 days. During this time, the skin may be slightly red and irritated. The effectiveness of the action is visible after 12 weeks, when the skin regenerates and regains full firmness.

The effects of microneedle mesotherapy include:

- improving skin elasticity and firmness,
- delaying skin aging processes,
- evening out skin tone and structure,
- reducing the visibility of enlarged pores,
- reducing sebum secretion by sweat glands,
- better blood flow through small blood vessels,
- reducing discoloration and redness,
- smoothing wrinkles around the eyes, mouth, and forehead,
- smoothing scars and evening out the color of various types of scars,
- minimizing stretch marks,
- regeneration and deep nourishment of the skin.

1.7. Thermogenique

It belongs to the group of treatments performed on the body and consists of peeling a given part of the body and then using specially developed thermoactive cosmetics and 4 heads that have different applications:

- cavitation liposuction – reduces the volume of fat cells,
- radio waves – have a smoothing, firming and rejuvenating effect,
- vacuum massage – drains lymph and water stagnation and has an anti-cellulite effect,
- thermogenic technology – stimulates the body to burn fat more and convert it into heat energy.

Most clients only feel slight discomfort during vacuum massage, during which the head sucks the skin, reducing fat tissue. Thermogenique is a treatment that is best performed before the summer season, so as not to expose the skin to sunlight. For the best results, a series of 6 to 8 treatments should be performed.

The main assumptions of thermogenic technology are:

- reduction of fat tissue and cellulite,
- body sculpting,
- stimulation of metabolism and circulation,
- reduction of wrinkles,
- skin tightening and lifting,
- thermogenic approach to collagen regeneration,
- skin elasticity.

The Meltivio device, which works on a monopolar radio wave of 448 kHz, using the phenomenon of diathermy, also has a similar effect. This technique uses electrical energy or radio waves to generate heat in the skin, and thus the benefits are similar to those of thermogenique.

1.8. Bodydermology

This is a type of treatment that uses innovative technology of massage rollers, the task of which is to shape the body. Bodydermology stimulates the subcutaneous tissue, stimulating the circulation of lymph and blood. As a result, cell metabolism improves, and toxins are removed from the body. Regular sessions of treatments can

help reduce swelling, which is extremely beneficial for people struggling with the problem of water retention in the body. The Crosha device is effective in treating many problems related to the body and figure.

Undergoing bodydermology helps to firm the body, burn fat tissue, and reduce the visibility of cellulite. Thanks to the innovative device, two types of treatments can be performed. The first one uses massage rollers, the main purpose of which is to reduce cellulite. During the treatment, the client puts on a one-piece suit.

The second treatment focuses on modeling and shaping the body using 3 heads, which additionally help to burn fat and smooth and firm the body:

- cavitation liposuction – responsible for burning fat,
- vacuum massage with massage rollers – its main purpose is to reduce cellulite,
- radio waves – fulfills tasks such as smoothing and firming the skin.

In addition to the innovative technology of the Crosha device, bodydermology guarantees clients high cosmetic effectiveness and provides effects such as:

- stimulation of blood circulation,
- stimulation of cell metabolism,
- reduction/complete reduction of cellulite,
- reduction of body circumference,
- lymphatic drainage,
- smoothing and firming of the skin structure.

To achieve the best results, cosmetologists recommend performing the procedure twice a week, in a series of 8 to 12 treatments in total.

1.9. Laser epilation

It is the most durable treatment available on the cosmetic services market, the task of which is to get rid of unwanted hair. Laser energy penetrates the skin, where it detects the pigment and destroys the bulb, which stimulates the production of hair pigment (melanin), and then transforms into thermal energy. This process is known as selective photothermolysis, causing carbonization of hair stem cells. The device used during this treatment is Laser-IQ.

The effectiveness of epilation is influenced by several factors:

- skin and hair color – the darker the hair and the lighter the skin, the greater the effectiveness of the laser,

- hair thickness,
- depth of hair location – the effectiveness decreases if the hair is embedded deeper,
- type and quality of the laser epilation device,
- reliable and properly performed treatment by a cosmetologist.

1.10. Skin fractionation and reduction of erythema/discoloration

A modern treatment supported by the Laser-IQ device involves the use of laser energy to stimulate natural collagen production by performing a series of micro--injuries. This method is best in the case of complex skin lesions, scars, wrinkles and stretch marks.

Improving skin density is one of the main advantages of skin fractionation. Reduction of wrinkles and fine lines is caused by increased production of natural proteins contained in skin cells. The treatment is also effective in reducing the visibility of post-traumatic and post-acne scars. Additionally, it reduces the visibility of pores, which leads to a more uniform skin surface.

The Laser-IQ is also a suitable tool for reducing erythema and skin discoloration. This technology involves the selective destruction of excess melanin and dilated blood vessels using a concentrated beam of laser light. The result of this process is the breakdown of pigment and the closure of blood vessels, which results in an even skin tone.

The fractionation procedure is minimally invasive and does not require anesthesia, and the recovery period lasts from 7 to 14 days. During this period, you should avoid sun exposure, use sun protection, and appropriate care products recommended by a specialist. After the procedure, the skin may be red and slightly swollen.

2. MATERIALS AND METHODS

The aim of the study was to identify the behaviors and attitudes of consumers on the cosmetic services market and towards treatment innovations.

The study included a selected group of respondents who completed a survey consisting of 22 questions and took part in an initial interview. The method used in the study was a survey questionnaire consisting of 17 questions regarding

the analysis of the attitudes of consumers using professional cosmetic treatments and 5 questions regarding personal data. The questions were closed, single and multiple choice, and a 3- and 5-point response scale was used. Clients of selected salons were invited to participate in the study (random sample). The study was voluntary, and the respondents agreed to provide answers regarding the cosmetic techniques used and not yet known.

The study group consisted of 48 people (42 women and 6 men), who were also clients of two medium-sized beauty salons in Buk and Poznan, offering a similar range of services (including the methods described in Chapter 2).

The dominant group of respondents turned out to be people aged 36–50 (58%), in second place where people ex aequo in the age group of 26–35 and over 50 (total 34%). The lowest level of engagement was demonstrated by respondents aged 18–25 (8%). The dominant place of residence of the respondents is a city with up to 50,000 inhabitants (46%). Some respondents live in the countryside (25%). The respondents represent four groups defining their education. The highest percentage are people with secondary education (43%), followed by people with higher education (master's degree) (29%) and higher bachelor's degree (17%). The smallest percentage of respondents are people with vocational education (5%) and people who do not provide their level of education (4%). The vast majority of respondents take up employment in public/private workplaces (75%). A smaller percentage of respondents run their own business (15%), while 10% of respondents prefer not to disclose such personal data.

3. RESULTS

When asked about the frequency of using professional beauty treatments, respondents answered once a month (54%), then occasionally/depending on needs (29%), while the least frequently chosen answer was several times a week (9%).

Most respondents indicated treatments focused on the face (69%) as the most frequently used. Body treatments were less popular, accounting for only 19% of all choices.

The vast majority of respondents (81%) expressed openness to experimenting with new care methods. However, there were people (19%) who were uncertain about their readiness for new treatments.

63% of respondents are aware of the existence of new methods and techniques used in beauty treatments, which suggests a relatively good knowledge of current trends. Difficulties with defining their knowledge on this subject were declared by 17% of respondents. Lack of awareness of innovations in the field of professional treatments was declared by 21% of respondents.

Respondents (21%) confirmed that they search for information on new products in the field of professional cosmetic treatments very often. Additionally, 25% of respondents declared that they search for information on this topic often, which indicates the existence of an active group interested in following new products in professional cosmetic treatments. Surprisingly, the answers indicating the search for information were marked similarly: very rarely (31%) or rarely (31%). Unfortunately, such answers suggest that the majority of respondents are not actively involved in searching for news in this field.

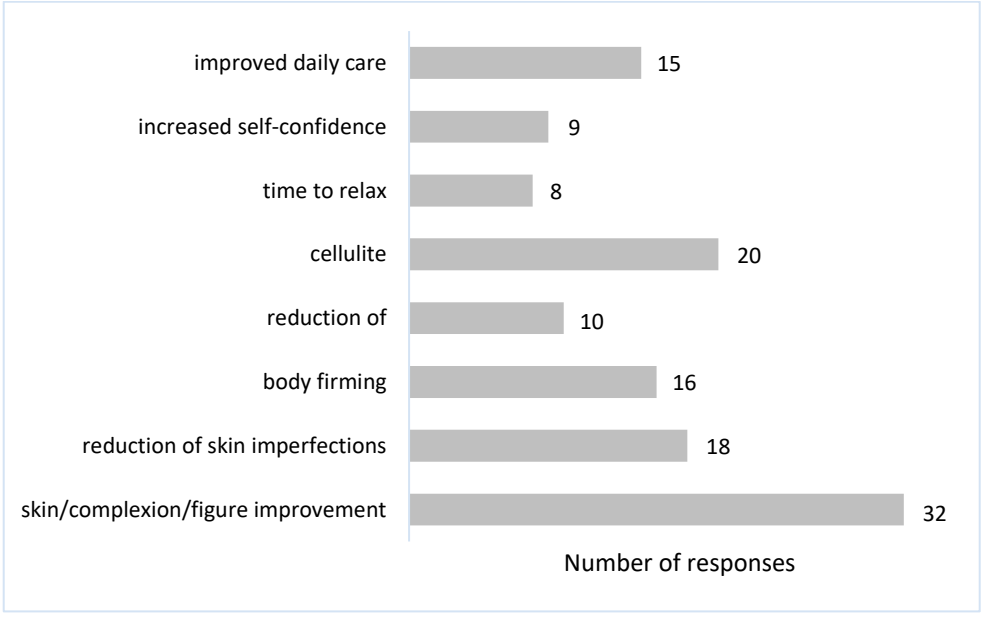

Figure 1. Respondents' expectations regarding treatments

Source: own study.

The vast majority of respondents (67%) expressed a preference for treatments that improve the overall condition of the skin/complexion/body (Figure 1). Important aspects were expectations regarding the reduction of skin imperfections and the allocation of time for relaxation (38%). The issue of increasing self-confidence was of the least importance to respondents (17%). The results suggest that expectations regarding the improvement of skin condition, body shaping and using the duration of the treatment as an opportunity to relax were chosen as priorities.

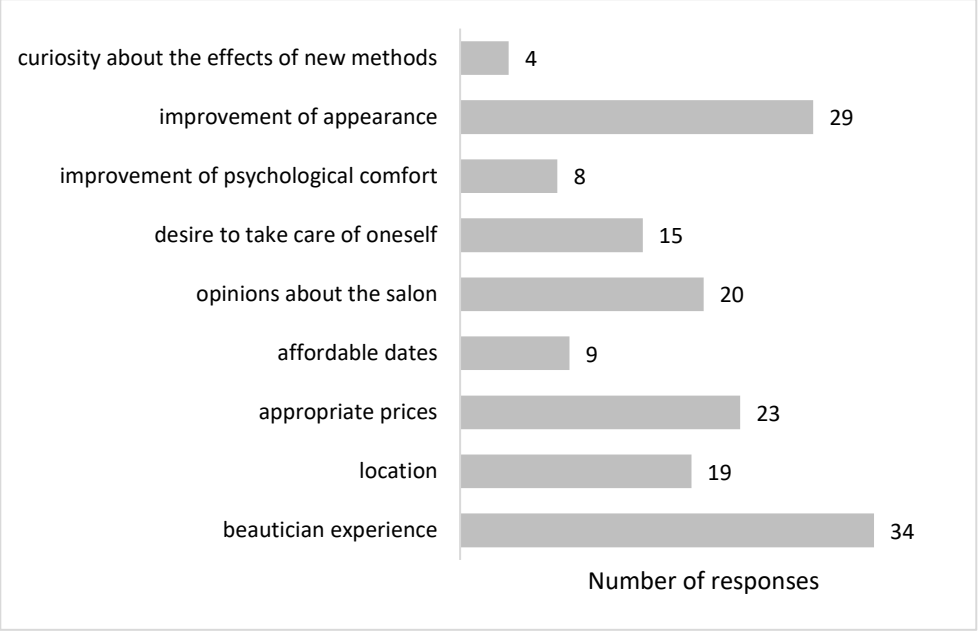

Figure 2. Factors motivating the use of treatments

Source: own study.

The experience of the beautician was the main determinant of using treatments (71%), equally important were appropriate prices (48%) and the desire to improve one's appearance (61%) – Figure 2. Experienced beauticians can offer clients more comprehensive and professional advice on skin care and choosing the right treatments, which translates into better results and customer satisfaction. Appropriate prices can help eliminate financial barriers for people who want to improve their appearance, which can increase the accessibility of cosmetic services

for different social groups and emphasize their importance for overall well-being and self-confidence. It is worth noting that there was no desire among respondents to discover innovative ways of skin care (8%). This may suggest that respondents prefer proven treatments over risky, new, unfamiliar methods.

The survey results clearly indicate a positive impact of innovation on the effectiveness of treatments, with the vast majority of respondents (83%) supporting this thesis. At the same time, a small number of respondents (6%) disagree with this statement. However, there is also a group of respondents (10%) who believe that it is difficult to clearly state whether innovations have a significant impact on the effectiveness of treatments. This distribution of responses suggests that most people consider innovations to be a key factor in improving the effectiveness of cosmetic treatments, which may be reflected in the growing trust in new technologies and the increasing expectations of customers for modern solutions used in the cosmetics industry. Half of the respondents rated the cosmetologist's communication regarding the transfer of information about the treatments performed as excellent. This indicates proper contact with clients and the ability to present treatment information. The respondents' response is ambiguous due to the assessment of communication as good (22%) and average (29%). The reason for such low ratings may be the lack of interest in the details of the activities performed on the part of the cosmetologist and the client.

Half of the respondents were willing to pay extra for a procedure that would allow them to try out innovative technologies. 22% and 29% were negative or hesitant, respectively. The results may suggest that there is a significant group of customers who are willing to invest additional funds in modern cosmetic treatments based on innovative technologies. For some customers, price is not a key factor, and the quality and effectiveness of the treatment, provided by new technologies, are more important to them.

It is worth noting that the majority of respondents (56%) admit that concerns about side effects influence their decision to try new treatments. This is significant because it indicates that customers are becoming increasingly aware of the risks associated with new cosmetic procedures. In addition, there is a group of people who find it difficult to decide whether concerns about side effects influence their decision or do not matter at all when choosing services. This suggests that for some respondents this issue may be ambiguous or there are different factors influencing their decisions. These findings indicate a need for greater education of consumers

regarding the side effects of various cosmetic treatments and the need to make them aware of the potential hazards and risks associated with new procedures.

40 respondents are aware of the risk after the procedure, which can affect both external factors, such as scarring, burns, and internal factors in the form of damage to mental health. Only 8 respondents are not aware of the post-procedure risk, which may indicate a lack of knowledge about the dangers associated with a given procedure or an approach that disregards all risks.

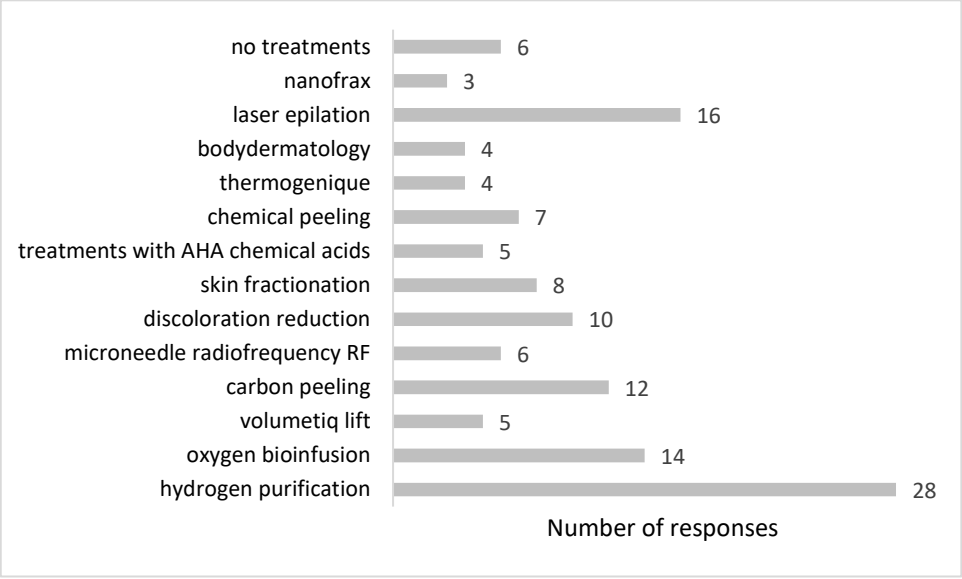

Figure 3. Choice of facial or body treatments in the last 12 months

Source: own study.

Analyzing the popularity of the treatments used (Figure 3), it can be stated that the most popular option was hydrogen purification, most likely due to its universal effect on the complexion and high level of safety. Treatments such as oxygen bio infusion, carbon peeling and laser epilation were also very popular. Their performance is determined in the best seasons, i.e., in the case of laser epilation, the best time to perform it will be the autumn-winter period, during which the body is not exposed to solar radiation. It is worth noting that 6 people decided not to use any

of the listed treatments in the last 12 months, which may suggest differences in the approach to skin care, cosmetic preferences, or financial situation.

Over 70% of respondents plan to regularly repeat selected cosmetic treatments. This is significant because it indicates their commitment to long-term skin care and maintaining the effects of treatments. Almost 18% of respondents have difficulty stating whether they plan to regularly repeat specific treatments. This may be due to various factors, such as uncertainty about the effects of treatments, changing skin needs or cosmetic preferences. It is worth noting that less than 11% of respondents do not plan to regularly repeat specific treatments, which may suggest that for some clients, regular use of treatments is not a priority, or they prefer other methods of care.

Analysis of the data regarding tracking of the beauty salon's social media for information about treatments shows that the vast majority of respondents, 75%, regularly use this source of information. This is an important finding, suggesting that social media plays a key role in communicating information about the beauty treatment offer and in building brand awareness. At the same time, although a minority of respondents (11%) do not follow the beauty salon's social media, this cannot be ignored, as it may indicate the existence of alternative communication channels or a lack of interest in beauty content in the modern media environment.

The majority of respondents (69%) admitted that promotions and special offers have a significant impact on their decisions to use modern beauty treatments. This result highlights the importance of promotional strategies in attracting customers and stimulating demand for new treatments. Over 10% of respondents were ambivalent, which may indicate the complexity of the decision-making process regarding trying modern treatments and individual customer preferences. Less than 22% of respondents stated that promotions and special offers do not influence their decisions. Choosing this answer suggests that other factors, such as quality of services or trust in a beauty salon, may be more crucial for them when making a decision.

4. DISCUSSION

Analyzing the survey results collected from individual groups, it can be concluded that respondents in the 36–50 age group regularly use facial and body treatments, primarily hydrogen purification, oxygen bioinfusion, and carbon peeling.

They are also more interested in innovation. Respondents aged 50+ readily return to their favorite salons and repeat familiar treatments, value convenience and easy access to beauty services. They are more hesitant about new offerings. Representatives of this group, like the 36–50 group, are equally eager to follow salons' social media and take advantage of promotions.

Young consumers use treatments sporadically, with laser hair removal and occasional preventative treatments being their most common options.

Men prioritize facial care and excessive hair removal. They are also interested in new beauty salon offerings.

No differences were found in the choices of cosmetic treatments among clients of the two selected salons (salon in Buk and in Poznań). Respondents prefer a natural look and choose treatments that enhance beauty rather than radically change it.

CONCLUSIONS

- The study confirmed the interest of clients in innovative cosmetic treatments and their openness to trying treatments using modern technologies. Despite concerns and considerable awareness of post-treatment risks, other determinants became an incentive for clients to have a positive attitude towards trying innovative treatments.
- Safety regarding the treatments performed is a very important factor for the respondents, without which it would be difficult to determine satisfaction and the level of trust in a beauty salon. The results of the study show the entire image of the client and their expectations, as well as the possibilities of improving the cosmetologist's approach to the work performed.
- The conducted research shows an increased interest in skin care and the need for its care. Beauty salons have gained great importance among people struggling with skin problems. The quality of services, cleanliness, hygiene, and the experience of the beautician are the main determinants of the respondents' choice of a given salon.
- Despite the unstable economic situation, there was a good price-quality ratio of the services offered, and consequently greater satisfaction and fulfillment of expectations among customers. The creation of loyalty packages and special

offers by salons is increasingly noticeable, as a result of which consumers are willing to stay in one place, where they feel appreciated and cared for.

- Social media, online reviews and recommendations from family or friends play a huge role in making the decision to choose a salon. The client is much more likely to consider salons that present their work on social media than in places where they do not receive enough information about services or treatments.
- A growing trend among consumers is to develop their own knowledge about health, care, and skin problems. Before visiting a salon, most customers search the Internet for information about a specific service, which results in an increased level of awareness and a desire to supplement the information, with the help of a chosen beautician.
- It is also worth looking at the need to take care of mental health among customers and combining services with holistic practices in salons. The modern cosmetics market offers many opportunities for consumers to take care of their health and beauty, and for salons to develop their business on many levels, from personalizing services, through introducing sustainable practices, to encouraging customers to follow a holistic approach in life.

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WILLINGNESS TO PAY FOR 'GREEN DELIVERY' AND ATTITUDES TOWARD ELECTROMOBILITY – PRELIMINARY RESEARCH

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Abstract

The aim of this study is to verify the assumption of a strong positive relationship between consumer attitudes toward EVs and their willingness to pay for green delivery, as well as to identify the degree of variation in attitudes toward EVs depending on demographic factors and environmental awareness. The study also examined whether this willingness is influenced by environmental awareness, place of residence, and frequency of online shopping. The survey was conducted on a sample of 122 respondents.

The analysis results showed a significant positive correlation between a favorable attitude toward electromobility and the willingness to incur additional costs for green delivery. Individuals who declared more eco-conscious consumer choices were significantly more willing to pay. Willingness to pay did not differ by place of residence. No significant correlation was found between frequency of online shopping and willingness to pay.

Keywords: electromobility, electric vehicles, green delivery, sustainable transport, last-mile logistics, consumer attitudes.

INTRODUCTION

The advancement of electromobility (EVs) and the increasing importance of sustainable logistics represent a significant response to contemporary environmental challenges associated with road transport. At both global and European levels,

the transport market is experiencing dynamic transformations, with electric vehicles being progressively recognised as a viable alternative to traditional combustion engine solutions [Breder et al. 2024]. Electromobility, supported by both political and technological initiatives, is emerging as a vital component of energy policy and corporate marketing strategies. In this context, pro-environmental practices enhance corporate reputation and demonstrate a commitment to social responsibility [Gajanová & Gorzelańczyk 2022].

Concurrently, research on consumer attitudes and behaviors is advancing, increasingly accounting for both economic and psychological determinants of purchasing decisions related to environmentally friendly transport solutions [Higueras-Castillo et al. 2020].

The literature emphasises the importance of examining not only the technical aspects of electromobility but also the social and market-related factors that influence its adoption. Of particular importance are consumers' attitudes towards electric vehicles, their perceptions of environmental impact, and their willingness to support pro-ecological initiatives, even when such choices entail higher costs. This perspective is reflected in the concepts of green marketing and last-mile logistics, wherein the utilisation of zero-emission modes of transport constitutes an element of market competitiveness [Gajanová & Gorzelańczyk 2022; Wierzbowski 2019].

Therefore, the aim of this paper is to discuss the theoretical foundations in four key thematic areas: (1) electromobility as a form of sustainable transport, (2) green logistics and green delivery in the context of e-commerce, (3) consumer attitudes towards electromobility and pro-environmental behavior, and (4) willingness to incur additional costs for environmentally friendly services. Furthermore, the objective of the present study is to verify the assumption of a strong positive relationship between consumer attitudes towards EVs and their willingness to pay a premium for more environmentally friendly delivery methods (e.g., by electric vehicle), as well as to identify the extent of variation in attitudes towards EVs determined by demographic factors and environmental awareness.

The conducted research is preliminary, with results that cannot be applied to the entire population, and serves primarily to test the tool, which is the original survey questionnaire.

1. LITERATURE REVIEW

1.1. Electromobility as a component of sustainable transport

Electromobility represents one of the fundamental pillars in transforming contemporary transport systems, primarily aimed at minimising the negative environmental impacts of the mobility sector. In light of increasingly stringent climate policies and the promotion of economic decarbonisation, electric vehicles are assuming a growing significance as alternatives to conventional combustion-engine vehicles [Breder et al. 2024].

The systemic adoption of electromobility is associated with numerous environmental and economic benefits. Electric vehicles contribute to the reduction of greenhouse gas emissions and air pollutants – a factor of particular relevance in urban areas that suffer from smog and excessive levels of air pollution [Wilczarska et al. 2024]. At the systemic level, electromobility enables a reduction in the external costs of road transport and facilitates improvements in the energy efficiency of the entire transport sector [Brdulak & Pawlak 2021].

At the national level, electric vehicles are seen as a means of modernising outdated logistics and transportation infrastructure. For example, in Poland, data from 2019 indicate that the average age of a passenger car was 14.1 years, reflecting a high level of emissions [Wierzbowski 2019]. Consequently, the electrification of the vehicle fleet is viewed as an opportunity to enhance the quality of road transport and align it with the objectives of sustainable development strategies.

At both the national and municipal levels, there is increasing interest in electric vehicles as instruments for implementing sustainable mobility policies. In urban contexts, electric vehicles contribute to enhancing residents' quality of life by reducing noise, exhaust emissions, and dependence on fossil fuels [Koman et al. 2024]. A practical illustration of such implementation is the introduction of electric buses into urban public transport systems, which – as demonstrated in a study conducted in Szczecin – have a positive effect on emission reduction. However, their overall efficiency is contingent upon the country's energy profile [Pietrzak & Pietrzak 2021].

Alongside ecological benefits, electromobility also entails several structural challenges, foremost among which are the limited availability of charging infrastructure, substantial investment costs, and the integration of electric vehicles

with existing energy and logistics systems. Recent analyzes emphazise that the integration of electromobility necessitates a well-designed tariff policy, the development of intelligent energy grids, and incentives for both consumers and logistics operators [Breder et al. 2024].

In sum, the implementation of electromobility should not be viewed merely as a technological transition to a new type of propulsion, but rather as a profound reform of the transport system, encompassing social, economic, and spatial dimensions. Accordingly, electromobility should be regarded as a key component of sustainable transportation, with far-reaching implications for market structures, consumer behaviour, and the functioning of cities and regions.

1.2. Green logistics and green delivery in e-commerce

The growing significance of electronic commerce constitutes one of the principal challenges for contemporary logistics systems. The handling of an increasing volume of orders exerts mounting pressure on both transport infrastructure and the natural environment. In the context of intensified efforts toward sustainable development, e-commerce logistics necessitates the implementation of solutions that minimise adverse environmental impacts. In response to these imperatives, the concept of green logistics has gained prominence, encompassing, among others, green delivery – defined as order fulfilment utilising low-emission transport modes and environmentally responsible operational practices [Kawa & Pierański 2022].

Green logistics refers to strategies that integrate environmental objectives with operational efficiency. Within the domain of online commerce, this entails not only reducing CO_2 emissions and fossil fuel consumption, but also optimising packaging management, utilising pick-up points (e.g., parcel lockers), and developing low--emission transport solutions, such as electric vehicles or cargo bikes [Doguchaeva et al. 2022]. Research indicates that the implementation of environmentally friendly solutions has a positive impact on customer satisfaction and loyalty, as consumers increasingly value the ecological dimension of logistics services [Kawa & Pierański 2022].

Simultaneously, the sector is witnessing dynamic growth in innovative delivery services that combine technological and ecological solutions. Frequently cited examples include electric tricycles, autonomous vehicles, drones, and last-mile

delivery sharing models [Saleh 2017]. Practical applications of green delivery models can be observed in companies such as Gotovo and B12 Zero Waste, which have introduced alternative delivery methods based on waste reduction and the circulation of reusable packaging [Doguchaeva et al. 2022].

On the Polish market, the rapid development of e-commerce has led to an increase in parcel volume and necessitated the adaptation of courier companies to evolving customer expectations. Analyses of changes within the domestic delivery sector highlight the growing importance of innovative logistics solutions designed to reduce the negative environmental impact of transport [Stopczyński 2017]. Notable developments include the expansion of parcel locker networks, the deployment of intelligent delivery management systems, and the increasing adoption of electric vehicle fleets [Gulc 2020].

Empirical studies conducted among Polish e-commerce customers have revealed a significant relationship between the inclusion of ecological considerations in delivery services and both reported shopping satisfaction and willingness to make repeat purchases. Consumers pay particular attention to factors such as packaging size and type, the form of delivery (PUDO – pick-up drop-off), and the transparency of information regarding the carbon footprint of the delivery process [Kawa & Pierański 2021].

Green delivery in e-commerce serves not only as a tool for building a competitive advantage but also as a response to systemic challenges related to urbanisation, congestion, and environmental constraints. Nevertheless, its effectiveness depends on a comprehensive approach that encompasses transport mode selection, route planning, packaging management, and consumer education. Only such an integrated strategy can deliver enduring environmental and business benefits [Gulc 2020; Saleh 2017].

1.3. Attitudes toward electromobility

Contemporary consumer decisions are increasingly influenced by environmental factors; however, the extent of this influence varies considerably depending on individuals' knowledge, experience, and socio-demographic characteristics. In the context of electric vehicles (EVs), there is a growing interest in environmentally friendly mobility solutions. Nevertheless, this interest does not

always translate into a willingness to purchase such vehicles or to support pro-environmental initiatives financially.

Empirical studies conducted in Poland confirm the ambivalent nature of attitudes toward electromobility. While as many as 66% of respondents declared that they consider electric vehicles environmentally friendly, only 37% expressed a willingness to purchase one. The most frequently cited barriers included high vehicle costs, limited driving range, and insufficient charging infrastructure [Karaś & Podgórniak-Krzykacz 2024]. Attitudes were also significantly influenced by prior experience with EVs: owners emphasised low operating costs and environmental benefits, whereas other respondents based their opinions primarily on general knowledge or media coverage [Gebauer et al. 2016].

The impact of direct contact with the technology on shaping attitudes toward electromobility has also been confirmed in experimental studies. Respondents who had the opportunity to familiarise themselves with fast-charging stations and test--drive electric vehicles exhibited significantly more positive attitudes than those without such experience [Gebauer et al. 2016]. These findings suggest that attitudes toward environmentally friendly technologies are not solely a function of ideological beliefs but are primarily determined by practical considerations, such as functionality and usability.

Environmental awareness plays a crucial role in shaping consumer behavior, including the willingness to support environmentally friendly solutions such as green delivery. Research conducted in Poland indicates that although consumers express positive attitudes toward electric vehicles at the declarative level, their actual knowledge regarding the environmental impact of EVs – particularly in the context of the national energy mix – is limited [Adamczyk et al. 2023]. Furthermore, respondents often fail to recognize the connection between their own consumer choices and broader environmental outcomes. This cognitive gap may hinder the willingness to pay extra for sustainable options, despite declared support for ecological ideals.

International research corroborates these findings. For instance, studies conducted in Slovakia indicate that the low willingness to purchase electric vehicles stems not only from objective cost-related barriers but also from limited environmental awareness and a lack of trust in the technology. Respondents emphasised the need to enhance infrastructure and intensify educational initiatives to increase public acceptance of electromobility [Rovňák et al. 2022].

Consumers' attitudes toward electromobility are therefore often characterized by declarative enthusiasm, which does not necessarily translate into concrete purchasing or financial decisions. The primary barriers remain the high cost of the technology, functional limitations, and a low level of environmental awareness. Factors that could foster a shift in attitudes include direct experience with the technology, enhanced environmental education, and clear, transparent communication of tangible ecological benefits.

1.4. Willingness to pay for environmentally friendly solutions

The concept of willingness to pay (WTP) holds a fundamental position in research on the valuation of intangible environmental benefits, including those associated with the adoption of sustainable forms of transportation and logistics. The literature highlights that WTP reflects not only consumer preferences but also serves as a practical instrument for analysing the social acceptability of environmental costs in both market and non-market contexts [Breidert et al. 2006].

Contemporary research demonstrates that WTP can be effectively utilised in the analysis of consumer behavior toward sustainable services, such as green delivery. Methods for measuring WTP are generally categorized as either direct or indirect [Breidert et al. 2006].

In the case of environmental services – such as deliveries conducted using electric vehicles – WTP is frequently employed as an indicator of consumers' readiness to incur higher costs in exchange for positive externalities, such as emission reductions. Practical applications of WTP are evident in studies related to public services and infrastructure projects in Poland. For instance, research conducted in rural municipalities indicates that residents are willing to bear additional costs for services contributing to environmental improvement; however, the level of willingness is significantly influenced by income and ecological awareness [Rauba 2016a; Rauba 2016b].

Another study focusing on residents' willingness to contribute financially to wastewater infrastructure development revealed that most respondents were prepared to accept an additional monthly fee of 5 to 15 PLN, provided that the investment resulted in clear environmental benefits and was effectively communicated to the local community [Rauba 2015]. These findings suggest that

WTP can serve as an indicator not only of economic, but also of social support for sustainable policies.

Despite the expanding body of research, an important distinction persists between willingness to pay (WTP) and willingness to accept (WTA) compensation. Both theoretical and empirical studies have shown that under conditions of limited availability of substitutes and strong reference effects, WTA often significantly exceeds WTP [Hanemann 1989; Horowitz & McConnell 2000]. This phenomenon, known as the asymmetry effect, is particularly salient in the context of public goods and services, such as air quality improvement or emission reduction in urban logistics.

From the perspective of policymakers and market practitioners, understanding WTP enables the design of more effective environmental policies and facilitates the assessment of the economic acceptability of implemented solutions. Moreover, WTP serves as a valuable tool for evaluating the cost-effectiveness of infrastructure and service implementations grounded in the principles of sustainable development.

2. METHODOLOGY

The study employed a quantitative research design and was conducted using an online survey method (CAWI – Computer-Assisted Web Interviewing) via the Facebook platform between April 1 and April 15, 2025. The questionnaire was made publicly available, and participation in the study was voluntary – interested individuals independently completed the form by accessing it through a link. The sampling method was non-random and convenient, and the research group consisted of 122 respondents. Therefore, it should be noted that this study is preliminary in nature, and its results are limited and cannot be considered a description of the entire population. Table 1 presents the sociodemographic characteristics of the respondents.

Table 1. Characteristics of the Research Sample (N = 122)

Variable	Categories	Number of respondents (n)
Gender	Female	84
	Male	38
Age	<18	0
	18–24	66

cont. Table 1

	25–34	45
	35–44	7
	45–54	3
	55+	1
Place of residence	Rural area	33
	Small town (<50,000 inhabitants)	12
	Medium-sized city (50–200,000)	20
	Large city (>200,000)	57
Frequency of online shopping	Less frequently	16
	Once or twice a month	44
	Several times a month	36
	Once a week	15
	Several times a week	11

Source: own study.

The questionnaire was divided into two sections. The first included demographic questions (e.g., gender, age, place of residence, education level, and frequency of online shopping). The second section contained questions regarding attitudes toward electromobility, environmental awareness, and willingness to incur additional costs for 'green delivery', i.e., delivery using an electric vehicle.

Attitudes toward electromobility and green logistics were measured using 10 evaluative statements (Table 2), to which respondents replied on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The total score obtained by each respondent constituted a synthetic attitude index (SUM), whose distribution was approximately normal (Shapiro-Wilk test: $p = 0.070$), which enabled the use of parametric analyses.

Table 2. Statements used to identify attitudes towards electromobility

No.	Statement	1	2	3	4	5
1.	Electric cars are a good direction for transport development.					
2.	Deliveries made using electric vehicles have a positive impact on the environment.					
3.	Green delivery increases my rating of the store's service quality.					
4.	I would be willing to pay more for a product if the delivery was more environmentally friendly.					
5.	Road transport has a significant impact on climate change.					

cont. Table 2

6.	Electric cars are more modern and friendly than combustion cars.					
7.	I feel responsible for making pro-ecological decisions as a consumer.					
8.	When choosing an online store, I would pay attention to whether it offers eco-friendly delivery options.					
9.	I believe that the development of electromobility should be supported by consumers, even if it involves higher costs.					
10.	Delivery by electric vehicle would give me the feeling that I am making responsible purchasing decisions.					

Source: own study.

To assess environmental awareness, responses to the question: 'In daily life, I choose products that are:' were used, coded from 1 ('definitely not eco-friendly') to 5 ('definitely eco-friendly').

Willingness to pay extra for EV delivery was measured through a question about the maximum acceptable surcharge, with five ordinal response options (ranging from 'not willing to pay at all' = 0, to 'more than 5 PLN' = 4).

The statistical analysis included the following tests:

- Shapiro-Wilk test – to assess the normality of variable distributions,
- Pearson's correlation – to test the relationship between attitude and willingness to pay (H1),
- Kruskal-Wallis test – to compare groups with different levels of environmental awareness (H2) and various places of residence (H3),
- Mann-Whitney U test – to compare willingness to pay between urban and rural respondents (alternative version of H3),
- Spearman's rank correlation – to examine the relationship between frequency of online shopping and willingness to pay (H4).

The data were analysed using the Python programming environment (libraries: pandas, scipy, seaborn, matplotlib), which enabled both hypothesis testing and results visualisation.

Research Questions:

1. What is the relationship between consumers' attitudes toward electromobility and their willingness to pay extra for green delivery services?
2. To what extent does the level of environmental awareness influence consumers' willingness to pay extra for electric vehicle (EV) delivery?
3. Does the willingness to pay extra for green delivery services vary depending on the respondents' place of residence (e.g., rural versus urban areas)?

4. How does the frequency of online shopping affect consumers' willingness to pay extra for EV delivery?

Based on the presented research questions, research hypotheses were formulated.
Hypothesis:
H1. There is a positive relationship between a favorable attitude toward electromobility and the willingness to pay extra for green delivery.
H2. Individuals with a higher level of environmental awareness are more willing to pay extra for EV delivery.
H3. Willingness to pay differs significantly depending on place of residence (e.g., rural vs. urban areas).
H4. Willingness to pay for EV delivery increases with the frequency of online shopping.

3. RESULTS

3.1. Relationship between attitudes toward electromobility and willingness to pay for green delivery

H1. There is a positive relationship between a favorable attitude toward electromobility and the willingness to pay extra for green delivery.

Attitudes toward electromobility were measured using 10 statements concerning opinions about electric vehicles, consumer responsibility, and green delivery. Respondents rated each item on a 5-point Likert scale (from 1 – strongly disagree, to 5 – strongly agree). The individual scores were summed to create a composite variable labelled attitudes toward electromobility.

Willingness to pay was assessed using the question: 'Would you be willing to pay extra for delivery made by an electric vehicle, if the cost were…?', with five ordinal response options:

- 0 – not willing to pay at all,
- 1 – up to 1 PLN,
- 2 – up to 2 PLN,
- 3 – up to 5 PLN,
- 4 – more than 5 PLN.

Responses were coded numerically as an ordinal variable.

Before proceeding with the analysis, the distribution of the attitudes toward electromobility variable was tested using the Shapiro-Wilk test ($W = 0.981$, $p = 0.070$), which indicated no significant deviation from normality (see Figure 1). This justified the use of Pearson's correlation test, a parametric method suitable for interval and ordinal data with approximately equal intervals.

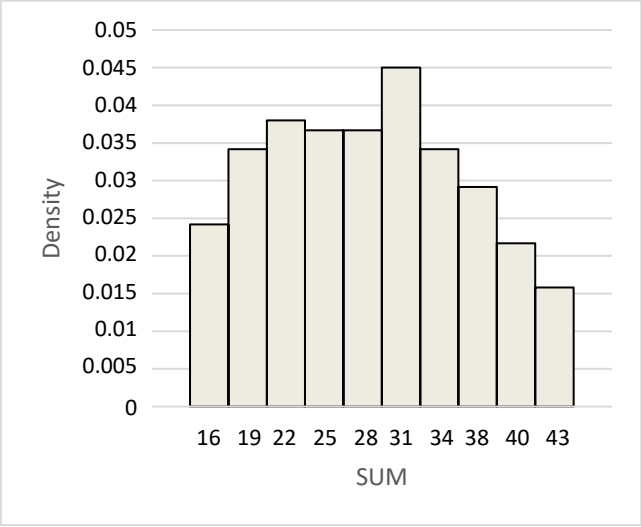

Figure 1. Distribution of the variable – attitudes toward electromobility

Source: own study.

The calculated Pearson correlation coefficient between the attitudes toward electromobility index and willingness to pay was: $r = 0.578$, $p < 0.001$. This result indicates a moderate, positive, and statistically significant relationship between the analysed variables. In other words, the more favourable a respondent's attitude toward electromobility, the greater their willingness to pay extra for environmentally friendly delivery.

Additionally, a linear regression analysis was conducted, which confirmed that attitudes toward electromobility significantly predict willingness to pay. The resulting regression equation is:

$$\textbf{Willingness to pay} = 0.071 \times \textbf{SUM} - 1.006$$

The coefficient of determination (R^2) was 0.334, meaning that the model explains over 33% of the variance in willingness to pay for green delivery (see Figure 2).

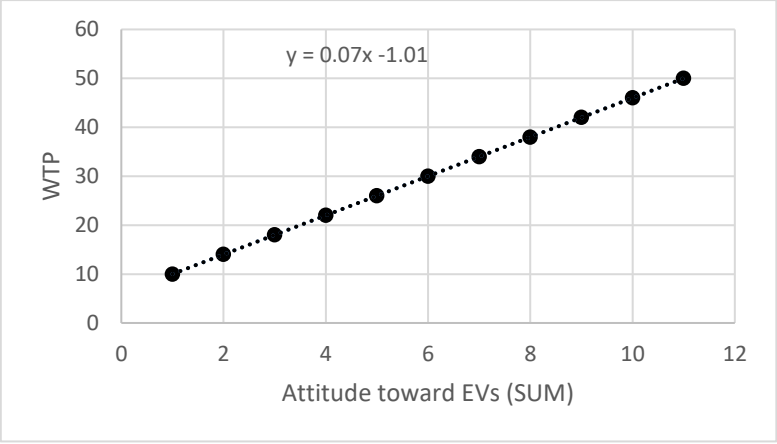

Figure 2. Relationship between attitudes toward electromobility and willingness to pay

Source: own study.

This relationship supports the assumption that individuals with a positive attitude toward the development of modern, low-emission transport technologies are also more inclined to support such solutions as consumers. The study demonstrated that ideological support for electromobility translates into concrete, practical consumer declarations, which may be particularly relevant in the context of implementing paid green delivery options in e-commerce.

The results confirmed a significant, positive relationship between favorable attitudes toward electromobility and willingness to pay for environmentally friendly delivery. The Pearson correlation coefficient ($r = 0.578$, $p < 0.001$) and the linear regression model ($R^2 = 0.334$) indicate that more substantial support for the development of electromobility corresponds to a greater willingness to incur additional costs.

H1 was confirmed. Verification of H1 is the answer to Research Problem 1.

3.2. Relationship between environmental awareness and willingness to pay extra for EV delivery

H2. Individuals with a higher level of environmental awareness are more willing to pay extra for EV delivery.

Environmental awareness was measured with the question: 'In daily life, I choose products that are:'. Respondents selected one of five options, ranging from 1 – 'definitely not eco-friendly' to 5 – 'definitely eco-friendly'.

WTP for EV delivery was operationalised identically as in H1.

Since both the independent variable (environmental awareness) and the dependent variable (willingness to pay) are ordinal, the Kruskal-Wallis test was used – a non-parametric alternative to ANOVA, appropriate for data that do not meet the assumption of normality. Additionally, boxplots were generated to visualise the distribution of willingness to pay across levels of declared environmental awareness (see Figure 3).

The Kruskal-Wallis test revealed statistically significant differences in willingness to pay among the groups ($H = 9.04$, $p = 0.029$).

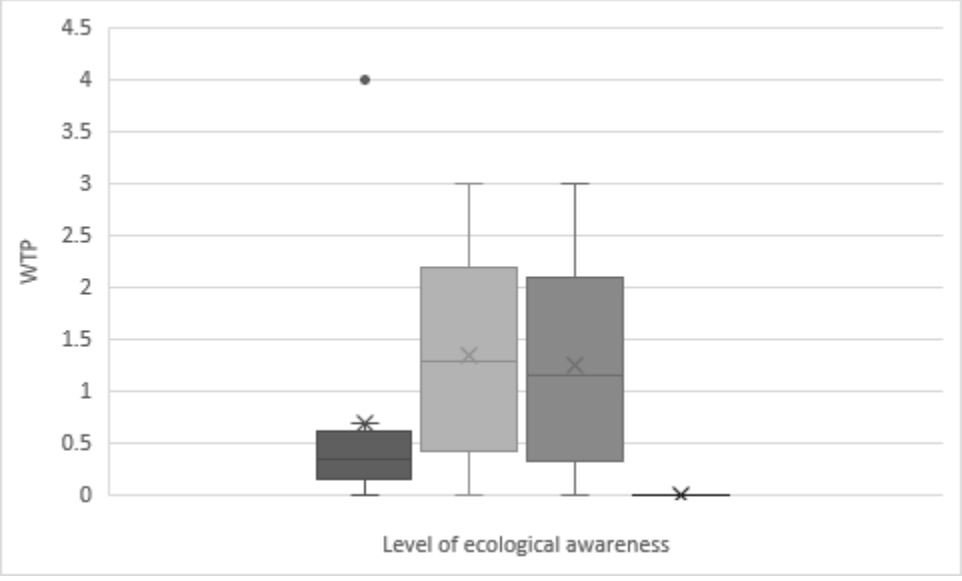

Figure 3. Boxplot – willingness to pay vs. level of environmental awareness

Source: own study.

The results suggest that individuals who declared relatively eco-friendly or definitely eco-friendly consumers (responses 4 and 5) were significantly more willing to pay extra for EV delivery compared to those with neutral or low awareness (e.g., responses 2 or 3). The group selecting '3 – it does not matter to me' exhibited notably lower median levels of willingness to pay.

These findings confirm that environmental awareness is a significant predictor of consumer attitudes regarding sustainable transportation. Individuals who identify as environmentally conscious are more likely not only to choose products aligned with their values, but also to accept real financial costs for the sake of environmental protection.

This relationship may be significant for e-commerce companies and logistics providers, as it suggests that segmenting customers based on ecological attitudes may facilitate the successful implementation of paid green delivery options.

Individuals declaring a higher level of environmental awareness were significantly more willing to pay extra for delivery carried out by an electric vehicle. The Kruskal-Wallis test ($H = 9.04$, $p = 0.029$) revealed differences between groups – pro-environmental choices in daily life correlate with consumer behavior.

H2 was confirmed. Verification of H2 enabled us to find the answer to Research Problem 2.

To further explore the results obtained for H2, a post hoc analysis was conducted to identify specific differences in willingness to pay (WTP) for electric vehicle (EV) delivery among respondents with varying levels of ecological awareness. Since the Kruskal-Wallis test revealed statistically significant differences between groups, pairwise comparisons were performed using the Mann-Whitney U test, a non-parametric alternative to the t-test, which is suitable for ordinal and non-normally distributed data. Given the multiple comparisons, a Bonferroni correction was applied to control the family-wise error rate.

Participants were grouped into four levels of ecological awareness based on self-assessment: (2) 'Rather not ecological', (3) 'It does not matter to me', (4) 'Rather ecological', and (5) 'Definitely ecological'. There was no group of respondents declaring (1) 'definitely not eco-friendly' identified. The pairwise tests revealed that the only statistically significant difference (after Bonferroni adjustment) was observed between group 3 and group 4 ($p = 0.0417$). This suggests that individuals who describe themselves as 'rather ecological' demonstrate significantly greater willingness to pay for sustainable delivery than those who remain indifferent.

No significant differences were observed between the most or least ecologically engaged groups, possibly due to smaller sample sizes. These findings reinforce the role of moderate ecological awareness in shaping pro-environmental consumer behavior.

3.3. The influence of place of residence on willingness to Pay for green delivery

H3. Willingness to pay differs significantly depending on place of residence (e.g., rural vs. urban areas).

Respondents were asked to indicate their place of residence by choosing one of four categories: rural area, small town (up to 50,000 inhabitants), medium-sized city (50,000–200,000), large city (more than 200,000 inhabitants). Willingness to pay was coded as in the previous hypotheses, from 0 (not willing) to 4 (willing to pay more than 5 PLN).

Since the variable willingness to pay does not follow a normal distribution (Shapiro-Wilk test: $p < 0.001$, see Figure 4), and the independent variable (place of residence) is categorical, the Kruskal-Wallis test was applied – an appropriate method for comparing multiple groups with ordinal or non-normally distributed data.

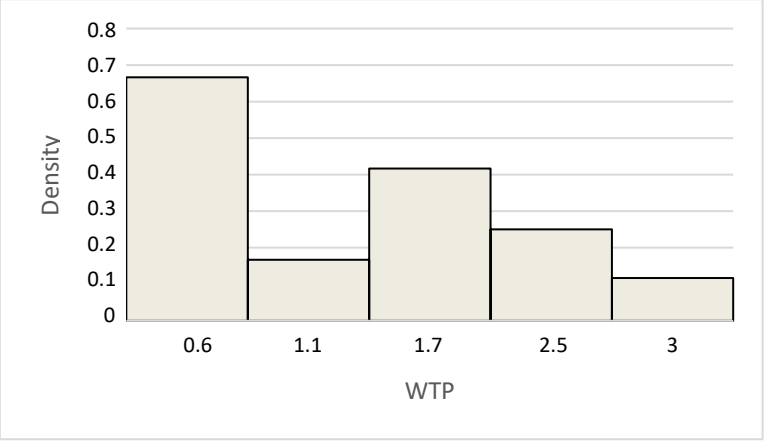

Figure 4. Distribution of willingness to pay extra for green delivery (Scale 0–4)

Source: own study.

To better illustrate the observed differences (or lack thereof), a boxplot visualisation was also prepared, showing the distribution across the four residence categories.

The analysis initially included all four categories of respondents' place of residence (complete segmentation – see Figure 5). Results of the Kruskal-Wallis test (complete segmentation):

- Test statistic: 4.57,
- p-value = 0.206.

These results indicate no statistically significant differences in willingness to pay across the four categories of place of residence.

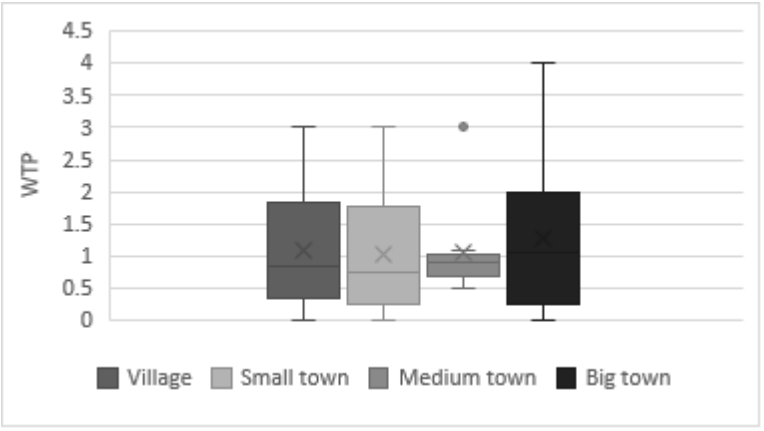

Figure 5. Willingness to pay for green delivery by place of residence

Source: own study.

The test results were not statistically significant, indicating no observable differences in willingness to pay among respondents from different types of localities.

Therefore, an additional analysis was conducted, simplifying the place of residence variable into two categories: rural and urban (with the urban category combining small, medium, and large cities). The Mann-Whitney U test, appropriate for comparing two independent groups, was applied. Test statistic: 1522.0, p-value = 0.738. This analysis also did not reveal statistically significant differences.

Neither the four-category nor the simplified rural/urban analyses provided evidence that place of residence influences consumers' willingness to support green logistics through additional payments. This may suggest that geographic factors play a smaller role than individual attitudes and beliefs. In the context of electromobility and e-commerce, consumer decisions appear to be more influenced by environmental awareness than by the location of residence.

Neither the Kruskal-Wallis test (for four categories) nor the Mann-Whitney U test (city vs. rural) showed statistically significant differences in willingness to pay.

H3 was not confirmed. Based on the verification of H3, the answer to Problem 3 was determined.

3.4. Relationship between frequency of online shopping and willingness to pay for green delivery

H4. Willingness to pay for EV delivery increases with the frequency of online shopping.

The frequency of online shopping was measured with the question: 'How often do you shop online?'. The responses were coded numerically as an ordinal variable:

- 1 – less frequently,
- 2 – once or twice a month,
- 3 – several times a month,
- 4 – once a week,
- 5 – several times a week.

Willingness to pay was coded as in the previous hypotheses, on a scale from 0 to 4.

Due to the ordinal nature of both variables and the absence of normality, the Spearman rank correlation was used – a non-parametric test for assessing monotonic relationships between two variables.

Two visualisations were used to supplement the analysis:

- a boxplot illustrating the distribution of willingness to pay by frequency of online shopping (1–5) (see Figure 6),
- a scatterplot with trend line showing the overall direction of the relationship (see Figure 7).

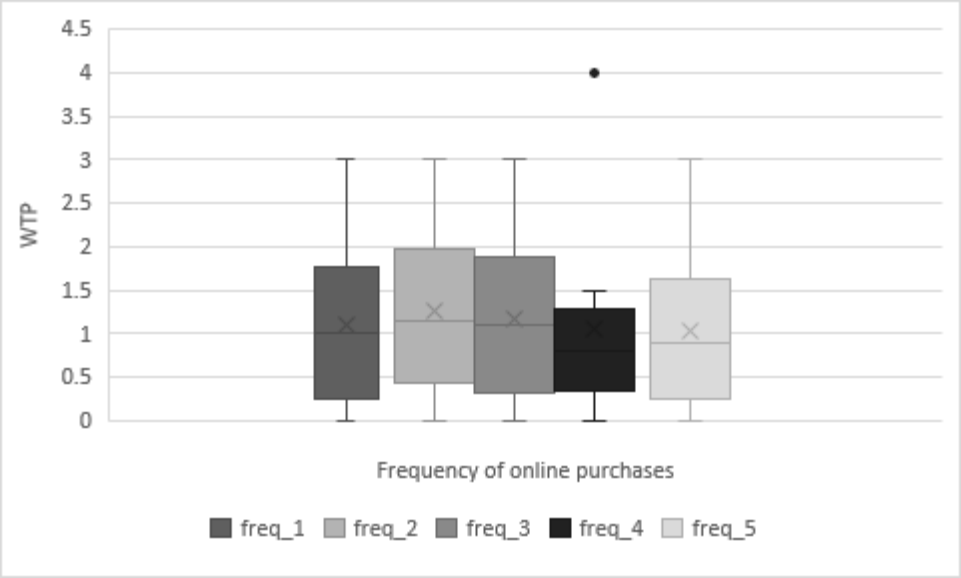

Figure 6. Boxplot – Willingness to pay for green delivery vs. frequency of online shopping

Source: own study.

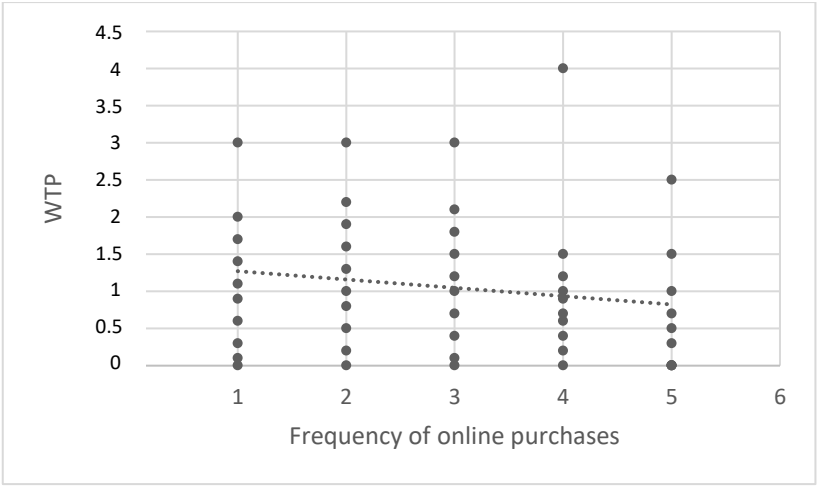

Figure 7. Frequency of online shopping vs. willingness to pay

Source: own study.

Results of the analysis:

- Spearman rank correlation coefficient: –0.126,
- p-value = 0.168.

The test results did not reveal a statistically significant relationship between the frequency of online shopping and the willingness to pay extra for delivery carried out by an electric vehicle. Interestingly, the correlation was slightly negative – individuals who shop more frequently online were not more willing to pay, and in some cases, appeared to be even less inclined to do so.

One possible explanation is that frequent online shoppers may be more sensitive to additional costs or may perceive e-commerce primarily as a convenience and a means of saving – factors that could make them less willing to incur extra charges, even in the name of environmental responsibility.

On the other hand, these results may also reinforce a conclusion drawn from earlier analyzes: it is not the frequency of purchases, but rather attitudes and environmental awareness that are the main determinants of consumers' willingness to support green logistics.

No significant relationship was found between the frequency of online shopping and willingness to pay for EV delivery. The Spearman correlation was statistically insignificant ($\rho = -0.126$, $p = 0.168$), indicating a slight negative trend.

H4 was not confirmed. Testing H4 allowed us to conclude Problem 4.

4. DISCUSSION

The results of the present study are consistent with previous findings in the literature, indicating that although consumers often declare a high level of environmental awareness and a positive attitude toward electromobility, their willingness to incur additional costs for environmentally friendly services remains moderate and is frequently shaped by situational context. Similar patterns have been observed in prior studies, where, despite declared support for green delivery options, factors such as price and delivery speed continue to play a decisive role in customers' decision-making processes [Villa et al. 2023]. This highlights the importance of ongoing consumer education about the environmental implications of purchasing decisions.

Examples from business practice demonstrate that the practical implementation of more ecologically friendly forms of delivery – such as the use of electric vehicles. – entails additional operational costs, which are increasingly passed on to end customers. According to data from Royal Mail and the MyParcel platform, during peak periods and in response to so-called green surcharges, certain providers introduce temporary fees to offset rising expenses associated with maintaining both efficiency and environmental standards in logistics operations [Royal Mail, 2024; MyParcel, 2024]. Simultaneously, industry organisations warn that such fees may double in the coming years, highlighting the need to reassess pricing strategies and align them with market acceptance levels [FIDI, 2023].

Furthermore, the existing literature confirms the effectiveness of financial incentives in steering consumers toward more sustainable delivery options – for example, by introducing surcharges for less environmentally friendly choices or offering discounts for selecting pickup points. Nevertheless, such strategies may adversely affect customer satisfaction, particularly when they are perceived as unfair or excessive. An alternative approach involves non-financial incentives, such as providing transparent information on the carbon footprint of deliveries, which – although less immediately effective – may contribute to long-term changes in consumer attitudes [Kokkinou et al. 2023].

CONCLUSIONS

The primary objective of the study was to assess whether consumers' positive attitudes toward electromobility and their level of environmental awareness influence their willingness to pay a premium for environmentally friendly delivery services, such as those utilising electric vehicles. Additionally, the study investigated whether variables such as place of residence and frequency of online shopping differentiate this willingness.

The research was conducted using the Computer-Assisted Web Interview (CAWI) method on a sample of 122 respondents. The collected data were analyzed employing appropriate statistical tests, including the Pearson correlation coefficient, linear regression analysis, the Kruskal-Wallis test, the Mann-Whitney U test, and the Spearman correlation coefficient. The results allowed for the verification of four

research hypotheses and the identification of key factors influencing attitudes toward sustainable logistics.

Based on the conducted statistical analyses, the following conclusions were drawn:

1. Attitude toward electromobility proved to be a significant predictor of willingness to pay for green delivery.
2. The level of environmental awareness influences consumer decisions.
3. Place of residence does not significantly affect willingness to pay.
4. Frequency of online shopping does not correlate with willingness to pay.
5. The strongest determinants of pro-environmental decisions are consumers' attitudes and values.

RESEARCH LIMITATIONS

The principal limitation of this study is its preliminary character. The fundamental objective was to statistically validate the research instrument, namely the author's survey questionnaire. According to the literature, it is recommended that each item subjected to statistical validation should receive at least five responses [Hair et al. 2019]. Given that the questionnaire comprised ten statements and two author-designed questions, the minimum sample size required for statistical validation was 60, a threshold that was doubled in this study. Nevertheless, a significant limitation is the purposive sampling method employed, as well as the exclusive use of a social media platform for data collection. However, such procedures are generally considered acceptable in preliminary research, which is not expected to be nationally representative.

Another limitation concerns the potential for social desirability bias among respondents. It is therefore possible that participants overstated their environmental attitudes to present themselves more favourably. For this reason, it is advisable that future, more comprehensive studies include the Marlowe-Crowne Social Desirability Scale (MC–C) to help control for this bias.

A further significant limitation of this preliminary study is the demographic profile of the sample, which was strongly skewed toward younger respondents – the majority being aged 18–34 – while older age groups were significantly underrepresented. Moreover, the omission of other potentially relevant demographic

variables, such as income level and occupation (both recognized determinants of economic decision-making and environmental engagement), constrains a more comprehensive understanding of the factors influencing willingness to pay.

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THE IMPACT OF PARENTAL INVOLVEMENT ON CHILDREN'S DIETARY HABITS: AN ANALYSIS OF THE RELATIONSHIP BETWEEN SOURCES OF NUTRITION KNOWLEDGE AND THE FREQUENCY OF UNHEALTHY PRODUCT CONSUMPTION AMONG CHILDREN

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Abstract

The objective of the present study was to examine the relationship between parental sources of information regarding dietary habits and the frequency of children's consumption of unhealthy products, including sweetened beverages, sugary snacks, and salty treats. The survey was conducted in six public primary schools located in the Pomeranian Voivodeship, Poland, between September 2022 and January 2023 and included children aged 7–15 years. A total of 515 mothers or legal guardians participated by completing a questionnaire and the collected data. The Internet and peer networks emerged as the predominant sources of knowledge, with allergies being the most commonly reported condition among these groups. Among parents acquiring knowledge from medical professionals, the majority indicated that their children had no diagnosed medical conditions; however, some did report allergies and respiratory diseases. Children whose parents acquired information from books and dietitians typically demonstrated moderate consumption of salty snacks, often restricting their intake to once a week or avoiding such snacks entirely. The findings revealed significant disparities in the frequency of consumption of sweetened beverages, confectioneries, and snacks based on

the source of nutritional information utilized by the parents. Specifically, parents who obtained their knowledge from professional sources, such as healthcare providers and nutritionists, reported that their children consumed sweetened drinks, sweets and salty snacks with less frequency compared to those who relied on information from the Internet or peers. Statistical analyses corroborated these associations ($p < 0.001$). The results indicate that parental education regarding healthy eating practices may significantly influence children's dietary choices.

Keywords: children, dietary habits, eating habits, obesity.

INTRODUCTION

The increasing prevalence of overweight and obesity among children and adolescents has garnered significant attention due to its associated adverse health implications that persist into adulthood [Pereira & Oliviera 2021]. Research indicates that dietary habits and lifestyle choices established during early years tend to endure throughout life, amplifying public health concerns globally, including in Poland [Arenaza 2020]. Unhealthy behaviors contributing to obesity encompass poor dietary choices, maladaptive eating patterns, insufficient physical activity, and sedentary behaviors [Sahoo et al. 2015]. Evidence suggests that childhood obesity frequently extends into later life, heightening risks for metabolic disorders, psychosocial challenges, and premature mortality, thereby underscoring its seriousness as a public health issue [Horesh et al. 2021; Saltaouras et al. 2024].

The dietary patterns evident during childhood play a crucial role in shaping growth, developmental milestones, academic outcomes, and long-term productivity [Jimeno-Martinez et al. 2024]. It is essential to comprehend the dietary habits of children to assess their health adequately. Various factors shape these eating behaviors, including the home environment, social interactions, and the contexts that influence perceptions and knowledge related to nutrition [Scaglioni et al. 2018]. Notably, food preferences emerge as significant determinants of children's dietary intake, heavily influenced by parental feeding practices [Rollins et al. 2014].

To effectively nurture healthy eating in children, parents must possess adequate nutritional knowledge to ensure their feeding strategies and food selections, including caloric intake, are appropriate [Jew et al. 2015]. This nutritional awareness

encompasses an understanding of the relationship between diet and health, dietary guidelines, and nutritional practices [Deshmukh & Goyal 2017]. Enhanced nutrition knowledge has been positively correlated with improved diet quality, which facilitates healthier food choices among consumers [Dumic et al. 2018].

The rising prevalence of obesity-related health complications in children, such as dyslipidemia, hypertension, hepatic steatosis, and psychosocial issues, is alarming [Apperley et al. 2022]. Overweight and obesity are precursors to numerous serious health conditions, including cardiovascular disease, type 2 diabetes, and certain cancers [Szajewska & Horvath 2017]. Effective management of childhood obesity should prioritize mitigating the risks or reversing the complications associated with obesity, rather than solely focusing on weight reduction. In this context, parents' understanding of healthy dietary practices is paramount [Skrzypek et al. 2021].

It has been observed that school-aged children are increasingly diverging from health-promoting dietary practices, with a notable rise in the consumption of sugary snacks and high-salt foods [Wawrzyniak & Traczyk 2024]. This trend, characterized by a preference for sweets and desserts, poses significant risks for children's growth and development [Dunford & Popkin 2018]. Furthermore, the excessive intake of sugary snacks may influence microbial growth negatively [Alkadi et al. 2024; Chen et al. 2024].

The burden of overweight and obesity is significant, contributing to the premature mortality and disability experienced across Europe, with obesity-related conditions accounting for over 1.2 million deaths annually, representing approximately 13% of total mortality in the region [Palandri et al. 2024].

This study aims to explore how various sources of parental knowledge regarding eating habits influence the frequency of children's consumption of sweetened beverages, sweets, and salty snacks. The analysis will identify the predominant sources of information utilized by parents-such as books, the Internet, health professionals, and peers-and examine their relationship to children's dietary practices. It is hypothesized that parents who seek guidance from professional sources, including doctors and nutritionists, will have children who display lower incidences of consuming sweetened products compared to those who rely on less credible sources such as the Internet or peer influence.

This study examines the role of parents' sources of knowledge in shaping children's eating habits. Although previous work indicates that parents have an important influence on children's diets, few studies to date have considered

the impact of specific sources of information used by parents. This study uses proven research methods to provide new data on this topic.

1. MATERIAL AND METHODS

The survey was conducted across six public primary schools located in the Pomeranian Voivodeship of Poland, spanning the period from September 2022 to January 2023 and included children aged 7-15 years. The schools were randomly selected. Participants were informed at the outset that the study maintained complete anonymity, and that the findings would be utilized exclusively for research purposes. Participation in the survey was entirely voluntary, and all respondents provided informed consent by acknowledging the patient information form and the presentation of the study.

The survey comprised 15 questions, structured into two distinct sections. The questions were single-choice. The first section aimed to gather fundamental demographic information about the respondents, while the second section focused on the dietary habits and behaviors of the participating mothers. The questionnaire was developed utilizing established instruments, notably the Child Eating Behavior Questionnaire (CEBQ) and the Food Frequency Questionnaire (FFQ), to effectively assess dietary habits and addressed the following aspects: diagnosed comorbidities of the child, frequency of sweet consumption, frequency of consuming sweets, snacks, and sweet beverages, as well as parental efforts in making the child aware of proper eating habits and their benefits [Wadolowska 2005]. The study included a comprehensive questionnaire administered to 540 mothers or legal guardians, aged 20 to 45 years (M = 35.3). The inclusion criteria required the proper completion of the questionnaire and the acquisition of the participant's consent to engage in the study. Exclusion criteria included incomplete responses and refusals to participate. Following data verification, a total of 515 responses were considered valid, thereby excluding 7 incomplete questionnaires and 18 instances of refusal to participate.

To facilitate participation, invitations were disseminated through school administrators, who shared the survey link across various platforms, including school websites, social media channels, and an electronic diary system known as Librus. The survey designed using Google Forms, specifically targeted mothers of children enrolled in the schools. Participants voluntarily engaged in the study,

assured of the anonymity and confidentiality of their responses. No personal identifiers or contact information were collected, and responses were finalized upon submission through a designated 'send' button. Importantly, no financial incentives were offered for participation.

The initial section of the questionnaire underscored the importance of informed consent, which each participant confirmed. The study adhered to the ethical principles articulated in the Declaration of Helsinki (2000), with a particular emphasis on non-maleficence, beneficence, justice, and autonomy. Moreover, personal and domain data were maintained in an anonymized format in compliance with the European General Data Protection Regulation (GDPR 679/2016). Due to the anonymous nature of the survey and the absence of tracking of sensitive personal information, the approval of an ethics committee was deemed unnecessary (NKBBN/487/2021). For the analytical component of the study, statistical software, including Statistica 12 Advanced Pack with Plus Kit, PQStat 1.8.0.438, and Excel 2007, was employed. The analysis focused on qualitative variables. To assess the relationships between categorical variables, the chi-square test was applied, with statistical significance set at $p < 0.05$. For cases where significant associations were identified, adjusted residuals were examined to detect which categories contributed most to the differences. In addition, correspondence analysis was performed to visualize and further explore the associations between parental sources of dietary knowledge and children's consumption frequencies of selected products (sweets, sweetened beverages, salty snacks). This combined approach enabled both the detection of statistically significant relationships and the identification of underlying patterns and clusters in the data.

2. RESULTS

2.1. Sources of parental knowledge about eating habits

Figure 1 shows the sources of the respondents' knowledge about eating habits. The internet was the most frequently indicated source (n = 35.73%), followed by books (n = 15.92%) and friends (n = 14.56%). Nutritionists (n = 13.40%) and doctors (n = 2.91%) were less frequently chosen as sources of information. 17.48% respondents declared that they had no interest in the topic of eating habits.

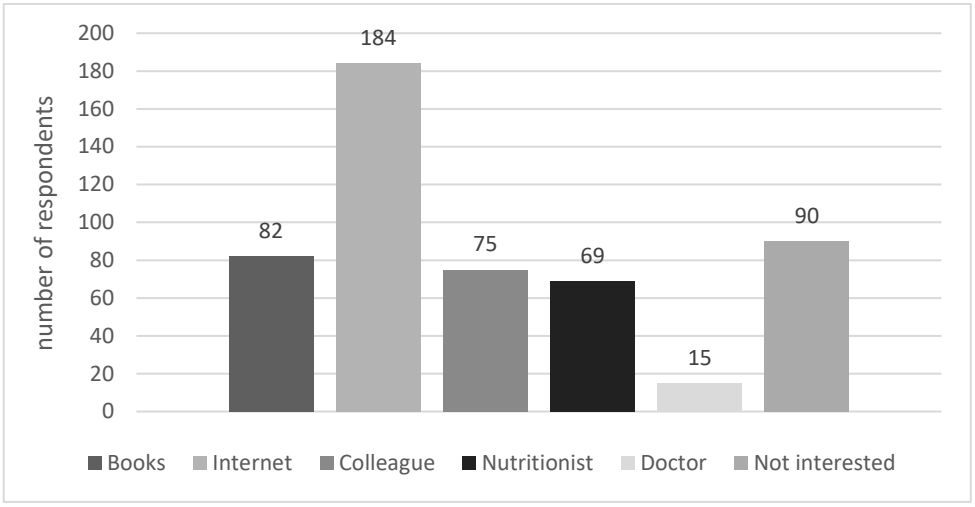


Figure 1. Sources of parental knowledge about eating habits

Source: own study.

2.2. Sources of knowledge about dietary habits and co-morbidities

The study carried out an analysis of the sources of knowledge about the dietary habits and comorbidities diagnosed in the children of the respondents. Among the parents who sourced their information from books, allergies in children were reported most frequently (n = 23), whereas respiratory diseases were noted less often (n = 2). A significant number of respondents indicated that their child had no medical conditions (n = 5).

The Internet and peer networks emerged as the predominant sources of knowledge, with allergies being the most commonly reported condition among these groups (n = 48). Additionally, there was a lower incidence of cases related to endocrine diseases (n = 47), diabetes (n = 1), and hypertension (n = 1). Notably, parents who sought consultations with dieticians were the least likely to report co-morbidities, implying a reduced incidence of medical conditions within this demographic. Similarly, among parents acquiring knowledge from medical professionals, the majority indicated that their children had no diagnosed medical conditions; however, some did report allergies (n = 4) and respiratory diseases (n = 1).

The findings suggest that the source of information regarding dietary habits has a considerable influence on the prevalence of co-morbidities in children. Specifically, reliance on books and consultations with dieticians is associated with a higher reporting of children with no medical conditions, while information sourced from the Internet and friends correlates with increased reports of allergies (Table 1).

Table 1. Sources of knowledge about eating habits and comorbidities

Sources of knowledge about eating habits	Comorbidities (diagnosed) of your children [%]										
	I	II	III	IV	V	VI	VII	VIII	None	All	p
Books	28.1	1.2	0.0	0.0	0.0	2.4	0.0	6.1	62.2	82	p < 0.001
Internet	26.1	25.5	0.5	0.5	0.0	1.6	0.0	2.2	43.5	184	p < 0.001
Colleague	64.0	5.3	0.0	8.0	6.7	2.7	0.0	4.0	9.3	75	p < 0.001
Nutritionist	18.8	1.4	0.0	0.0	0.0	0.0	0.0	7.2	72.5	69	p < 0.001
Doctor	26.7	0.0	0.0	0.0	0.0	6.7	0.0	13.3	53.3	15	p < 0.001
Not interested	50.0	4.4	4.4	3.3	6.7	1.1	2.2	2.2	25.6	90	p < 0.001
All										515	

I – Allergies, II – Endocrine diseases, III – Hypertension, IV – Diabetes, V – Heart diseases, VI – Respiratory diseases, VII – Cancer, VIII – Other.

Source: own study.

Based on the chi-square analysis, there is a statistically significant relationship ($p < 0.001$) between the source of knowledge about eating habits and the incidence of comorbidities in children. Parents who get their knowledge from friends – as many as 64.00% of children have allergies, which is the highest among all groups. In addition, the same group had the highest percentage of children with diabetes (8.00%) and heart disease (6.67%). On the other hand, parents receiving advice from dietitians have the lowest percentage of children with comorbidities – 72.46% of their children have no diagnosed diseases, suggesting a positive impact of professional advice on children's health. A similarly high percentage of healthy children was recorded in the group using books (62.20%). It is also worth noting the group of 'uninterested' in the topic of nutrition – their children relatively often

have allergies (50.00%), which may indicate the negative effects of lack of knowledge about proper eating habits. In conclusion, these results are statistically significant and suggest that the source of nutrition knowledge can have a significant impact on children's health, especially in the context of chronic diseases $p < 0.001$ (Table 1).

2.3. Children's sweet consumption frequency and sources of knowledge on eating habits

Table 2 presents an analysis of the relationship between various sources of knowledge regarding eating habits and the frequency of sweet consumption among the children of respondents. The sources of information examined include books, the Internet, friends, dieticians, doctors, and individuals with no interest in healthy eating.

The results indicate that among respondents who utilized books as their source of information, the largest number of them reported that their children consume sweets on a daily basis (n = 30), followed by a slightly smaller percentage indicating consumption one times per week (n = 26). Only a minimal number reported that their children refrain from consuming sweets altogether (n = 2). For respondents who relied on the Internet for information, the frequency of daily sweet consumption was notably higher (n = 108), with a small percentage indicating avoidance of sweets (n = 1).

Conversely, respondents who obtained their knowledge from friends predominantly reported daily consumption of sweets (n = 55), with very few children avoiding sweets completely (n = 1). Those who sought guidance from a dietician most frequently reported that their children do not consume sweets at all (n = 33), representing the highest proportion in this regard among the surveyed groups. In the category of respondents who consulted a doctor, the predominant response indicated that children consume sweets three times per week (n = 7), with a relatively low occurrence of daily sweet consumption.

In the group with no particular interest in healthy eating, the highest proportion of children exhibited no restrictions on sweet intake (n = 49). This analysis reveals a clear correlation between the source of knowledge regarding healthy eating and the eating habits of children, especially concerning sweet consumption. These findings

underscore the significant impact that the source of information on healthy eating has on the frequency of sweet consumption among children.

The chi-square analysis showed a statistically significant relationship ($p < 0.001$) between the source of knowledge about eating habits and the frequency of children's consumption of sweets. Parents receiving advice from dietitians – as many as 47.83% of children in this group do not consume sweets at all, the highest

of all the groups studied. At the same time, this group had one of the lowest percentages of children consuming sweets daily (10.14%). These results suggest that professional nutrition education can significantly reduce children's consumption of sweets. In contrast, the highest percentage of children consuming sweets daily is among those whose parents get their knowledge from friends – as many as 73.33% of children in this group eat sweets daily. Similarly, among parents who mainly use the Internet, as many as 58.70% of children eat sweets every day. The group of 'uninterested' in nutrition topics also stands out negatively – as many as 54.44% of children consume sweets in unlimited quantities, which may suggest that lack of nutrition knowledge is associated with a higher risk of excessive sweets consumption. In conclusion, these results are statistically significant and indicate a strong influence of the source of nutrition knowledge on children's eating habits, especially in the context of candy consumption $p < 0.001$ (Table 2).

Table 2. Frequency of children's sweet consumption by sources of knowledge about eating habits

Sources of knowledge about eating habits	Frequency of consumption of sweets by the children							
	Not at all	1 time a week	3 times a week	Daily	Several times a day	Unlimited	All	p
Books	2.4%	31.7%	28.0%	36.6%	0.0%	1.2%	82	p < 0.001
Internet	0.5%	9.2%	21.7%	58.7%	2.2%	7.6%	184	p < 0.001
Colleague	1.3%	1.3%	6.7%	73.3%	2.7%	14.7%	75	p < 0.001
Nutritionist	47.8%	20.3%	11.6%	10.1%	2.9%	7.2%	69	p < 0.001
Doctor	0.0%	26.7%	46.7%	13.3%	6.7%	6.7%	15	p < 0.001
Not interested	1.1%	2.2%	21.1%	18.9%	2.2%	54.4%	90	p < 0.001
All							515	

Source: own study.

2.4. Relationships between sources of knowledge about eating habits and frequency of consumption of salty snacks

Table 3 presents the correlation between sources of knowledge regarding eating habits and the frequency of children's consumption of salty snacks. The findings indicate an association between the indicated sources of nutritional knowledge and the self-reported consumption of sweets, salty snacks, and sweetened beverages by children. Children whose parents acquired information from books and dietitians typically demonstrated moderate consumption of salty snacks, often restricting their intake to once a week (n = 36, n = 41) or avoiding such snacks entirely (n = 24, n = 41). Conversely, parents who relied on information from the Internet and peers reported that their children consumed salty snacks more frequently, often three times per week (n = 42, n = 29) or even daily (n = 60, n = 13). Furthermore, parents who exhibited a lack of interest in healthy eating tended to provide their children with unlimited access to salty snacks, suggesting insufficient monitoring of these dietary habits (n = 47). These results substantiate the assertion that the source of information regarding healthy eating has a profound influence on children's eating habits, particularly in terms of the restriction or absence of restriction concerning salty snack consumption.

The chi-square analysis showed a statistically significant relationship ($p < 0.001$) between the source of knowledge about eating habits and the frequency of children's consumption of salty snacks. As in the case of sweets, the most favorable results were observed in the group of parents receiving advice from nutritionists – as many as 59.42% of children in this group do not consume salty snacks at all, the highest among all the groups studied. Moreover, only 5.80% of children in this group consume snacks daily. These results again suggest that professional nutrition education can significantly reduce children's consumption of unhealthy products. The highest percentage of children who consume salty snacks daily is among those whose parents get their knowledge from the Internet – as high as 26.09%. The 'uninterested' group on nutrition also stands out negatively, with as many as 52.22% of children consuming salty snacks in unlimited quantities, which may indicate a lack of control over this aspect of nutrition. In summary, these results are statistically significant and indicate a strong influence of the source of nutrition knowledge on children's consumption of salty snacks. Groups using reliable, professional sources of knowledge show more favorable eating habits, whereas lack

of interest or reliance on less reliable sources is linked to higher consumption of salty snacks, as confirmed by the chi-square test ($p < 0.001$) (Table 3).

Table 3. Relationship between sources of knowledge on eating habits and frequency of consumption of salty snacks

Sources of knowledge about eating habits	Frequency of consumption of salty snacks by the children							
	Not at all	1 time a week	3 times a week	Daily	Several times a day	Unlimited	All	p
Books	29.3%	43.9%	18.3%	4.9%	1.2%	2.4%	82	p < 0.001
Internet	9.2%	37.5%	19.6%	26.1%	0.0%	7.6%	184	p < 0.001
Colleague	6.7%	36.0%	34.7%	8.0%	2.7%	12.0%	75	p < 0.001
Nutritionist	59.4%	20.3%	5.8%	5.8%	1.4%	7.2%	69	p < 0.001
Doctor	20.0%	60.0%	13.3%	0.0%	0.0%	6.7%	15	p < 0.001
Not interested	10.0%	14.4%	18.9%	2.2%	2.2%	52.2%	90	p < 0.001
All							515	

Source: own study.

2.5. Children's consumption of sweetened beverages according to source of parental knowledge of eating habits

Table 4 depicts the correlation between the sources of knowledge regarding eating habits and the frequency with which children consume sweetened beverages. The analysis indicates that parents who acquire their knowledge from books and nutritionists are more likely to reduce their children's consumption of sweetened drinks. Notably, children of parents who seek advice from dietitians are the least likely to consume such beverages ($n = 48$), suggesting that professional guidance is particularly effective in mitigating intake. Furthermore, parents who utilize information from books also exhibit a tendency to decrease their children's consumption of sweetened beverages ($n = 36$), albeit to a lesser degree than those who follow the recommendations of dietitians. Conversely, parents who rely on information available on the Internet tend to have children who consume sweetened beverages more regularly, including on a daily basis ($n = 60$).

Additionally, parents who lack an interest in healthy eating are the most likely to impose no restrictions on their children's intake of sweetened beverages (n = 47). The findings highlight a statistically significant relationship between the source of knowledge regarding healthy eating and the frequency of children's consumption of sweetened beverages.

The chi-square test indicated a statistically significant association between the source of knowledge about dietary habits and the frequency of children's consumption of sweetened beverages ($p < 0.001$). The most favorable outcomes were once again observed among parents who sought advice from nutritionists, with 69.57% of children in this group completely avoiding sweetened beverages. Notably, only 4.35% of children in this category consume them daily. These findings suggest that professional dietary guidance plays a key role in minimizing the intake of sweetened drinks. Conversely, the highest proportion of daily sweetened beverage consumption was recorded among children of parents who relied on doctors for nutritional advice, with 33.33% consuming them every day. A similarly high percentage (32.61%) was found among children whose parents obtained information from the Internet. The group of parents uninterested in nutrition once again showed the most concerning trend – 52.22% of their children consumed sweetened beverages without any restrictions, indicating a potential lack of parental oversight in this aspect of diet. In summary, these statistically significant results highlight the strong impact of parental knowledge sources on children's dietary habits, particularly regarding the consumption of sweetened beverages $p < 0.001$ (Table 4).

Table 4. Children's consumption of sweetened beverages according to the source of parents' knowledge of eating habits

Sources of knowledge about eating habits	Frequency of consumption of sweetened beverages by the children							
	Not at all	1 time a week	3 times a week	Daily	Several times a day	Unlimited	All	p
Books	43.9%	22.0%	22.0%	6.1%	3.7%	2.4%	82	p < 0.001
Internet	25.5%	12.5%	22.8%	32.6%	0.0%	6.5%	184	p < 0.001
Colleague	9.3%	20.0%	38.7%	17.3%	2.7%	12.0%	75	p < 0.001
Nutritionist	69.6%	10.1%	7.2%	4.3%	2.9%	5.8%	69	p < 0.001
Doctor	46.7%	13.3%	6.7%	33.3%	0.0%	0.0%	15	p < 0.001

cont. Table 4

Not interested	2.2%	6.7%	22.2%	15.6%	1.1%	52.2%	90	p < 0.001
All							515	

Source: own study.

2.6. Making children aware of good eating habits and their benefits

An analysis of data indicates that most parents, regardless of their sources of nutritional knowledge, report that they impart this information to their children. Parents who acquire their knowledge from books and online resources are particularly inclined to engage in discussions related to healthy eating (n = 72, n = 163), thereby demonstrating their active involvement in the nutrition education of their children. Additionally, parents seeking guidance from dietitians exhibit high percentage of reported transmission of this information (n = 65), suggesting that professional support may enhance the emphasis on educating children about nutrition.

In contrast, a considerable proportion of parents who exhibit a lack of interest in healthy eating habits do not relay this information to their children (n = 48). A similar trend is observed among parents who predominantly rely on advice from peers, where a lower percentage address the topic of healthy eating with their offspring (n = 32). The analysis illustrates that the source of knowledge concerning eating habits significantly influences the dissemination of this information to children. The statistical analysis revealed a substantial correlation between the source of knowledge and parents' efforts to make their children aware of proper eating habits and their benefits.

The chi-square analysis showed a significant relationship ($p < 0.001$) between the source of knowledge about eating habits and parents' awareness of educating their children about proper nutrition and its benefits. The highest percentage of parents consciously teaching their children about healthy eating was observed in the groups drawing knowledge from nutritionists (94.20%) and doctors (93.33%). These results suggest that access to reliable sources of knowledge translates into active formation of healthy habits in children. The worst results were in the 'uninterested' group, where as many as 53.33% of parents do not undertake any educational activities in this area. This means that children from these families are most likely to lack knowledge about healthy eating and its consequences.

In conclusion, the results obtained are statistically significant and indicate a strong influence of the source of nutrition knowledge on children's eating habits $p < 0.001$ (Table 5). Parents who use professional and proven sources of knowledge (nutritionists, doctors) are significantly more likely to educate their children about healthy eating.

Table 5. Making children aware of good eating habits and their benefits

Sources of knowledge about eating habits	Are you making your child aware of proper eating habits and their benefits?			
	Yes	No	All	P
Books	87.8%	12.2%	82	$p < 0.001$
Internet	88.6%	11.4%	184	$p < 0.001$
Colleague	57.3%	42.7%	75	$p < 0.001$
Nutritionist	94.2%	5.8%	69	$p < 0.001$
Doctor	93.3%	6.7%	15	$p < 0.001$
Not interested	46.7%	53.3%	90	$p < 0.001$
All			515	

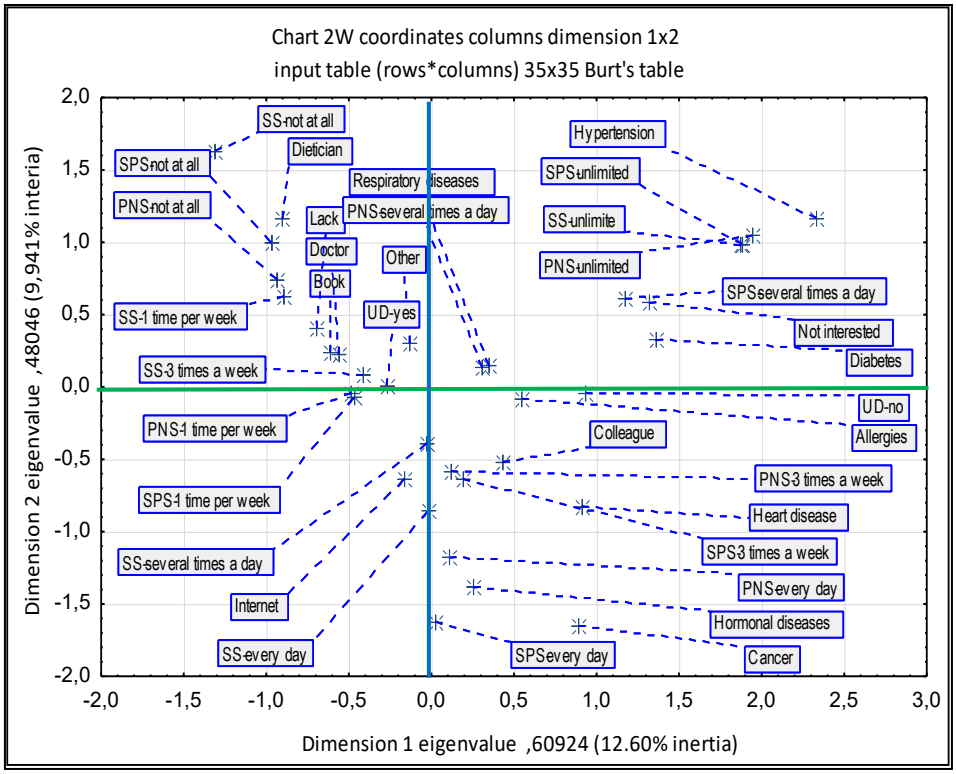
Source: own study.

2.7. Relationship between sources of knowledge about eating habits and children's frequency of consumption of sugary drinks and salty snacks – correspondence analysis

The study used a correspondence analysis that examines the relationship between sources of knowledge regarding dietary habits and the frequency of children's consumption of sugary beverages and salty snacks. This survey delineates how various sources of nutritional information, including books, the Internet, peer influence, healthcare professionals, nutritionists, and a lack of interest in the subject, correlate with the frequency of children's consumption of these products.

The analysis reveals that parents who obtain their knowledge of dietary practices from healthcare professionals and nutritionists tend to report a lower frequency of their children's consumption of sugary drinks and salty snacks. Notably, categories such as 'Sweet drinks – not at all' (SS-Whole) and 'Salty snacks – not at all' (SPS-Whole) are positioned close to the variables representing 'Dietitian'

and 'Doctor'. This proximity suggests that individuals utilizing these sources of knowledge may possess a greater awareness of the health implications associated with unhealthy eating habits, thereby encouraging their children to limit the intake of these products. Conversely, respondents who rely on the Internet and peer influence for nutritional information are positioned nearer to the categories indicative of more frequent consumption of sugary drinks and salty snacks, such as 'Every day' (SS-Daily, SPS-Daily). These correlations imply a potential association between less reliable sources of information and increased consumption of unhealthy foods among children.



SS – consumption of sweets; SPS – eating salty snacks; PNS – drinking sweetened beverages; UD – making the child aware.

Figure 2. Relationship between sources of knowledge about eating habits and frequency of consumption of sweet drinks and salty snacks by children – correspondence analysis

Source: own study.

Additionally, it is noteworthy that the group of respondents expressing a lack of interest in the topic of healthy eating ('Not interested') reports a higher incidence of unrestricted consumption of salty snacks and sugary beverages among their children. This particular category is distinctly placed within the graph, setting it apart from the other sources of knowledge (Figure 2).

Overall, the correspondence analysis highlights clear patterns linking professional sources of nutritional knowledge with healthier eating behaviors in children. In contrast, reliance on less reliable sources or lack of interest is associated with more frequent consumption of unhealthy products, underlining the importance of credible nutrition education in shaping dietary practices.

3. DISCUSSION

The findings of our study suggest that parental nutritional knowledge is associated with children's eating habits, which aligns with existing literature on the role of parents in shaping dietary behaviors. Numerous scientific publications underscore the significance of parents as primary role models in shaping children's dietary behaviors and highlight the importance of shared family meals in fostering healthy eating patterns. For example, Mahmood et al. [2021] indicated in their review that parental eating habits markedly impact their children's dietary choices, irrespective of variables such as gender, age, or socio-economic status [Mahmood et al. 2021]. Similarly, the study conducted by Dimitratos et al. [2022] revealed that parental modeling of eating behavior and the application of moderate restrictions significantly influence children's long-term food preferences [Dimitratos et al. 2022].

Our research reveals that the Internet serves as the predominant source of nutritional information for parents, corroborating the findings of other studies. In particular, a study by Aleid et al. [2024] suggests that parents frequently utilize social media and various websites to acquire information regarding healthy eating for their children. These findings reflect a growing trend in which the Internet is recognized as an educational tool, especially due to its ease of access and the rapid dissemination of information on health and nutrition [Aleid et al. 2024]. This trend is particularly evident among younger mothers, indicating a shift away from traditional media, such as books and professional advice [Yau et al. 2022].

Furthermore, our study demonstrates that parents who seek consultation with dietitians are more likely to promote awareness of the health benefits associated with proper eating habits among their children. This assertion is echoed in the research of Woźniak et al. [2022], who emphasize that professional consultations lead to enhanced knowledge regarding healthy eating and facilitate the effective transmission of this knowledge to children [Woźniak et al. 2022].

An inadequate diet represents a significant preventable risk factor for various health conditions. In 2017, it was estimated that diet-related risk factors contributed to approximately 11 million deaths globally. Conditions linked to poor dietary habits include cardiovascular diseases (such as hypertension, myocardial infarction, and stroke), diabetes, certain types of cancer, and osteoporosis [Afshin et al. 2019]. Individual dietary behavior and nutrient intake are influenced by nutritional knowledge, which plays a crucial role in enabling individuals to make informed dietary choices, identify healthy products, and comprehend the relationship between a balanced diet and health outcomes. This knowledge not only governs daily habits but also enables individuals to adapt to the varying nutritional needs of their bodies throughout different life stages, thereby minimizing the potential for nutrient deficiencies or excesses [Sun et al. 2021].

However, the impact of nutritional knowledge on dietary behavior can vary based on the quality of information available and its sources, which may include the media, the Internet, or professional consultations. According to Żarnowski et al. [2022], long-term studies are essential for the continuous monitoring of dietary habits and eating patterns. He highlights the potential of new technologies, such as mobile applications, to be effectively utilized in supporting nutrition education [Żarnowski et al. 2022].

The overwhelming volume of dietary information accessible through television commercials, magazine articles, blogs, and publications by public figures can lead to confusion among the public regarding what constitutes a healthy diet. Segal & Rachelle [2015] advocate for the formulation and implementation of national dietary strategies capable of producing meaningful change. Such strategies should encompass multiple components, including marketing reforms, regulatory restrictions on the advertising of unhealthy foods, appropriate food labeling, and publicly funded dietetic services [Segal & Rachelle 2015]. Furthermore, dietetic services ought to be integrated into primary health care and adequately funded to ensure access to individualized dietary support for individuals at risk and those with

existing chronic conditions. The prevalence of asthma and allergic diseases has notably increased in recent decades, raising significant public health concerns [Wang et al. 2018]. Numerous studies attribute this rise to alterations in dietary patterns. Research indicates that individuals residing in developed nations have embraced a Western lifestyle characterized by diets predominantly comprised of fast food, processed foods, and added sugars [Murray et al. 2015]. Frequent consumption of processed items, including sugary and salty snacks as well as sweetened beverages, has been linked to various health conditions, such as obesity, hypertension, diabetes, and cardiovascular disease.

In our study, 181 out of 515 respondents reported experiencing allergies, which accounts for 35.15% of the pediatric population surveyed. These findings are consistent with a study conducted by Silveria et al. [2015], which revealed that children whose mothers obtained their nutritional knowledge from anecdotal sources, such as websites, were at an elevated risk of developing asthma and other allergic conditions. A key contributing factor identified was the excessive consumption of sweets, associated with an increased likelihood of allergic reactions and the emergence of diet-related illnesses [Silveira et al. 2015].

Furthermore, research by Nkosi et al. [2020] identified that the consumption of processed foods on three or more occasions per week constituted a significant risk factor for wheezing and asthma [Nkosi et al. 2020]. Our research similarly indicates a considerable proportion of children consume sweets and salty snacks regularly. Specifically, 182 children, representing 35.34% of the study sample, reported frequent consumption of sweets, inclusive of sweetened beverages. According to findings by Duleva et al. [2023], approximately 24.2% of children consumed salty snacks, like chips, most days of the week or every day, while nearly 49.7% consumed sweet snacks, including candies and cookies. This consumption pattern is associated with an increased incidence of various health conditions, paralleling the outcomes of our study [Duleva et al. 2023].

Moreover, a study conducted by Blaszczyk-Bębenek et al. [2023] found that 22.1% of boys and 12.8% of girls consumed sweetened beverages at least once per week ($p = 0.0003$) [Błaszczyk-Bębenek et al. 2023]. In addition, research by Żwirska et al. [2023] indicated that fast-food products were consumed monthly by 68.5% of girls and 44.4% of overweight and obese boys [Żwirska et al. 2023].

In summary, access to credible sources of nutritional information is essential for the development of healthy eating habits and the mitigation of diet-related diseases. The results of our study corroborate findings from other researchers, underscoring the necessity to promote reliable sources of knowledge and evidence-based nutrition education.

However, some limitations of this study should be noted. It was conducted through a questionnaire made available to mothers of children attending elementary schools. In the questionnaire, the women were asked to evaluate their children's eating habits and behavior, which may lead to subjective responses, as is quite often observed in this type of study. The survey was conducted only in the northern part of Poland with a representative sample, which may be a limitation. Our study is only a fragment of a broader study on the problem of overweight and obesity in children. Continued research is needed.

CONCLUSIONS

The analysis shows that sources of information about eating habits have a significant impact on the incidence of disease in children and the frequency with which children consume unhealthy products. Notably, parents who seek information from professional sources such as doctors and nutritionists are less likely to have children who regularly consume sweetened drinks, sweets, and salty snacks. Conversely, parents who rely on information from the internet or peers are more likely to have children who choose these unhealthy options. The results suggest that the source of information about dietary habits has a significant impact on the prevalence of comorbidities in children. In particular, reliance on books and advice from dieticians is associated with higher reports of children without medical conditions, while information from the Internet and friends is correlated with higher reports of allergies. Therefore, nutrition education for parents based on professional resources can play a key role in developing healthy eating habits in children. This underlines the need to strengthen educational initiatives to effectively inform parents about the benefits of good eating habits.

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NUTRITIONAL VALUE AND HEALTH BENEFITS OF CONVENTIONAL CHEESES FROM DIFFERENT PRODUCTION SEASONS

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Abstract

The aim of the study was to assess the nutritional value, with particular emphasis on the fatty acid composition, of mature cheeses available on the Polish market, produced from cow's milk from different seasons. A total of 20 cheese samples (10 samples of cheese produced from milk from the winter period and 10 samples of cheese produced from milk from the summer period) were analyzed. The studies showed that the season of production affects the chemical composition and fatty acid profile in cheeses. Cheeses produced from summer milk contained significantly ($p \leq 0.05$) more protein (26.42%) compared to cheeses produced from winter milk (23.92%). Cheeses made from summer milk also had a significantly higher ($p \leq 0.05$) content of MUFA (157.22 mg/g fat) and PUFA (16.03 mg/g fat) compared to cheeses produced from winter milk, where the average content of these acids was 118.57 mg/g fat and 14.71 mg/g fat, respectively. Cheeses produced from summer milk also had a significantly higher ($p \leq 0.05$) content of linoleic acid and conjugated linoleic acid (CLA) compared to cheeses produced from winter milk. On the other hand, cheeses produced from winter milk had a significantly higher ($p \leq 0.05$) content of short-chain fatty acids (SCFA) and a more favorable n-6/n-3 ratio.

Keywords: cheese, chemical composition, fatty acids, CLA.

INTRODUCTION

Cheeses are one of the most numerous and diverse group of dairy products, and its production is one of the main areas of milk processing. Countries such as France, Switzerland, Italy, England, and the Netherlands have centuries-old cheese-making traditions. Cheese production has also been known in Poland for several centuries. The huge variety of cheeses available, as well as the proven beneficial effects of their consumption on the body, have led to a dynamic increase in the consumption of these products. The high nutritional and dietary value of cheese results from its chemical composition; cheese contains high-quality protein with almost all the essential amino acids in amounts sufficient to meet the needs of an adult, fats that are easily absorbed by the body, as well as an adequate amount of vitamins and minerals necessary for the proper development and functioning [Cichosz & Czeczot 2010; Kolanowski & Świderski 1999; Kołakowski et al. 2013; Soszyńska 2013]. Depending on the type of cheese, 100 g of this product covers 30-40%, and even 100% of the body's daily calcium requirement and 12-20% to 40-50% of the daily phosphorus requirement [Renner 1993]. In addition, cheese is a rich source of bioactive peptides, which have a beneficial effect on hypertension [Walther et al. 2008] and the most easily digestible animal fat. The important role of milk fat is related to the diversity of its composition, which includes over 400 fatty acids varying in length, with many health-promoting properties [Barłowska & Litwińczuk 2009; Jensen 2002; Parodi 2004; Pfeuffer 2001]. A characteristic feature of milk fat is the presence of short--chain fatty acids (SCFA): C4:0 to C10:0, among which butyric acid has a beneficial effect in the treatment of inflammatory bowel diseases, infectious diarrhea, and functional bowel disorders [Przybojewska & Rafalski 2003a; Skrzydło-Radomańska 2019]. It has also been shown that SCFA do not contribute to an increase in blood lipid levels: they are rapidly metabolized in the liver and do not accumulate in adipose tissue [Przybojewska & Rafalski 2003a; Ciborowska & Rudnicka 2014]. Other fatty acids in milk fat that are important from a nutritional point of view including *cis*9 C18:1 oleic acid, which is classified as an essential fatty acid, linoleic acid (*n*-6) and linolenic acid (*n*-3), which determine the structure of cell membranes, are a source of tissue hormones, limit the synthesis of triacylglycerols, regulate insulin secretion, *trans*11 C18:1 vaccenic acid, which has anti-cancer properties, and *cis*9*trans*11 C18:2 conjugated linoleic acid (CLA), which is characterized by remarkable biological activity [Cichosz 2007; Hur et al. 2007; Jelińska 2005;

Mennella et al. 2015; Przybojewska & Rafalski 2003b; Turpeinen et al. 2002]. However, there is a view that the fatty acid profile is not stable in milk fat, but varies under the influence of many factors, such as: production season, production system, animal species, animal breed, lactation phase, and others [Barłowska et al. 2013; Frelich et al. 2012; Hanuš et al. 2016; Litwińczuk et al. 2018; Radkowska 2013]. Therefore, the composition of fat, including its fatty acid profile, is one of the most important factors determining the nutritional value of milk fat.

Hence, the aim of the study was to assess the nutritional value, with particular emphasis on the fatty acid composition of commercial cheeses from different production seasons.

1. MATERIAL AND METHODS

1.1. Tested material

The research material was commercial ripening cheeses produced from cow's milk available on the Polish market. The cheeses were purchased in two batches. The first batch consisted of cheeses produced from milk from the winter feeding period, which were purchased in May. The second batch consisted of cheeses produced from milk from the summer feeding period, purchased in November. The cheeses included in the study came from different producers and were purchased in stores in Olsztyn.

1.2. Analytical methods

1.2.1. Chemical composition

The fat, protein, water, and dry matter content of the cheese samples was determined using a FoodScan device (Foss, Hilleroed, Denmark).

1.2.2. Determination of fatty acid composition

The fatty acid composition of the fat extracted from the cheeses included in the study was determined using gas chromatography (GC). The fat was extracted from the cheeses using the Folch method [Krełowska-Kułas 1993]. Methyl esters were

prepared using the IDF method [ISO 15884:2002]. The determinations were performed using a Hewlett Packard 6890 gas chromatograph (Menster, Germany) with a flame ionization detector (FID) and a 100 m capillary column (Chrompack, Middelburg, Netherlands). CP Sil 88 phase, internal diameter 0.25 mm, film thickness 0.20 μm. The analysis was performed under the following conditions: initial column temperature 60°C (for 1 minute) to 180°C (Δt 5°C/min), detector temperature 250°C, injector temperature 225°C, carrier gas helium (gas flow 1.5 ml/min). The identification of fatty acid peaks was performed by comparing their retention times with the retention times of the reference milk fat (BCR Reference Materials) symbol CRM 164, fatty acid methyl ester standards from Sigma-Aldrich and Supelco, and literature data. The contents of the determined fatty acids in the fat extracted from the analyzed cheeses were calculated in relation to the introduced standard (methyl ester of C21:0 acid). The results are given in mg/g of fat. All analyses were performed in two parallel replicates.

The study presents the chemical composition and the total content of selected groups of fatty acids: short-chain fatty acids (SCFA), saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), *n*-3 and *n*-6 fatty acids, and the *n*-6/*n*-3 fatty acid ratio. Statistical calculations were performed using STATISTICA PL software.

2. RESULTS AND DISCUSSION

The results of the chemical composition analysis of the cheeses included in the study are presented in Table 1. The chemical composition of cheeses is characterized by variability, which may be due to differences in the composition of the raw material used in their production on the one hand, and differences in the production technology of these cheeses on the other. The tests showed that the dry matter, water, and fat content of the cheeses did not vary significantly depending on the season of production. The smallest differences were observed in the percentage of fat, which was 27.50% and 27.14% in cheeses made from summer milk and winter milk, respectively. According to the literature, the average fat content in mature cheeses ranges from 20 to 30% [Renner 1993].

Table 1. The chemical composition of the cheeses included in the study ($\bar{X}$ ± SD)

Specification [%]	Cheeses made from winter milk (n = 10)	Cheeses made from summer milk (n = 10)
Dry matter	55.92 ±1.16[a]	56.34 ±1.86[a]
Fat	27.14 ±0.69[a]	27.50 ±1.96[a]
Water	44.26 ±1.19[a]	43.70 ±1.82[a]
Protein	23.92 ±0.58[b]	26.42 ±1.23[a]

[a, b] – The mean values marked with different letters in the rows differ statistically significantly ($p \leq 0.05$).

Source: own study.

The protein content in cheeses from different production seasons differed significantly statistically ($p \leq 0.05$). Higher protein content was recorded in cheeses produced from winter milk, 23.92%. In cheeses made from summer milk, protein accounted for 26.42%. Cheeses are characterized by a high degree of variation in terms of protein content. The average protein content, depending on the type of cheese, ranges from 10% in cottage cheese to as much as 37.5% in Parmesan cheese [Renner 1993]. Research conducted by Ochrem et al. [2017] showed a varied protein content in traditional cheeses produced in the Podhale region. According to these authors, the protein content ranged from 15.72% in bundz cheeses to 25.35% in smoked oscypek cheeses.

Analysis of the fatty acid composition of the cheeses studied showed that, regardless of the season of production, saturated fatty acids (SFA) were the most abundant in the fat of these cheeses. The average content of this group of acids in cheeses produced from winter milk was 383.24 mg/g of fat, while in cheeses produced from summer milk it was significantly lower ($p \leq 0.05$), at 253.51 mg/g of fat (Table 2). Cheeses produced from winter milk also had a significantly higher ($p \leq 0.05$) average content of short-chain fatty acids (SCFA) compared to cheeses produced from summer milk, which is consistent with the results obtained by Grega et al. [2005]. In the fat separated from the cheeses produced from summer milk included in the study, the average content of monounsaturated fatty acids (MUFA) was 157.22 mg/g of fat and was significantly higher ($p \leq 0.05$) than the average content of this group of acids determined in cheeses produced from winter milk (Table 2). The analyzed cheeses produced from summer milk were also characterized by a significantly higher ($p \leq 0.05$) content of polyunsaturated fatty acids (PUFA). PUFA in milk fat are mainly linoleic acid (C18:2, *n*-6) and linolenic

acid (C18:3, *n*-3). The research conducted showed that the production season had a significant impact on the level of C18:2 acid in the cheeses analyzed. In cheeses produced from summer milk, this acid accounted for an average of 9.04 mg/g of fat, while in cheeses produced from winter milk, it was significantly lower ($p \leq 0.05$) (6.61 mg/g of fat). On the other hand, no significant differences were found in the linolenic acid (C18:3) content in the analyzed cheeses from different production periods. From a nutritional point of view, the ratio of *n*-6/*n*-3 fatty acids is of particular importance. Excessive amounts of *n*-6 acids and a high *n*-6/*n*-3 ratio promote the pathogenesis of many diseases, while a higher content of *n*-3 acids in the diet (low *n*-6/*n*-3 ratio) has a positive effect [Hu 2001; Simopoulos 2008; Wijendran & Hayes 2004]. The study showed that in the cheeses produced from winter milk, the *n*-6/*n*-3 ratio was significantly lower ($p \leq 0.05$) than in cheeses produced from summer milk (Table 2). Hirigoyen et al. [2018] showed that the *n*-6/*n*-3 ratio in 'Colonia' cheeses produced from cow's milk produced in spring was 4.47 and 3.29 in cheeses produced in autumn.

Table 2. The content of selected fatty acids and group of fatty acids (mg/g of fat) in thea analyzed cheeses ($\bar{X} \pm$ SD)

Specification	Cheeses made from winter milk (n = 10)	Cheeses made from summer milk (n = 10)
Σ sum of short-chain fatty acids (SCFA)	42.52 ±6.44[a]	39.02 ±9.38[b]
Σ sum of saturated fatty acids (SFA)	383.24 ±38.12[a]	253.51 ±49.51[b]
Σ sum of monounsaturated fatty acids (MUFA)	118.57 ±30.69[b]	157.22 ±35.53[a]
including cis9 C18:1	92.85 ±26.99[b]	125.99 ±32.61[a]
Σ sum of poliunsaturated fatty acids (PUFA)	14.71 ±2.21[b]	16.03 ±1.39[a]
including cis9cis12 C18:2, n-6	6.61 ±1.36[b]	9.04 ±0.49[a]
including cis9cis12cis15 C18:3, n-3	1.98 ±0.36[a]	2.05 ±0.46[a]
including cis9trans11 C18:2 (CLA)	2.40 ±0.60[b]	3.23 ±0.91[a]
n-6/n-3	3.34 ±1.05[b]	4.35 ±0.79[a]

[a, b] – The mean values marked with different letters in the rows differ statistically significantly ($p \leq 0.05$).

Source: own study.

The studies conducted paid particular attention to the content of conjugated linoleic acid (*cis*9*trans*11 C18:2 (CLA)), which is important from a nutritional point of view and characteristic of milk and dairy products. The CLA content in milk depends on many factors, one of which is the way animals are fed depending on the season. The CLA content in milk from the grazing period is almost four times higher than in milk from the barn feeding period [Żegarska et al. 2006]. In turn, according to the literature, the content of this acid in dairy products is influenced by many factors, including the quality of the raw material used in their production, the type of bacteria used in the production process, the length of the ripening period and conditions, and the additives used [Jiang et al. 1998; Kim et al. 2009; Zlatanos et al. 2002]. The studies showed that in cheeses produced from summer milk, the average CLA content was 3.23 mg/g of fat, while in cheeses produced from winter milk, the average content of this acid was significantly lower ($p \leq 0.05$), at 2.40 mg/g of fat (Table 2). The CLA content in rennet cheeses tested by Białek & Tokarz [2009] averaged 2.40 mg/g of fat (range from 0.50 to 6.25 mg/g of fat). Higher CLA contents were found in our own studies conducted in 2015. In commercial cheeses purchased on the market in Olsztyn between September and November, the CLA content ranged from 7.98 mg/g of fat to 9.65 mg/g of fat [Paszczyk & Łuczyńska 2017].

CONCLUSIONS

Based on the research conducted, it can be concluded that the production season has an impact on the chemical composition and fatty acid profile of cheese. Cheese produced from summer milk contained more protein, making summer cheese a better choice for consumers who need more of this nutrient in their daily diet. Cheeses from this period were also characterized by a significantly higher content of MUFA and PUFA unsaturated fatty acids, a higher content of linoleic acid and conjugated linoleic acid (CLA). On the other hand, cheeses produced from winter milk were characterized by a significantly higher content of short-chain fatty acids (SCFA) and a more favorable *n*-6/*n*-3 ratio. Considering the growing variety of cheeses available on the market and the increasing consumer awareness regarding healthy food choices, evaluating the quality of cheeses available on the Polish market is of great importance.

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QUALITY ASSESSMENT OF FROZEN SHARK MEAT

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Abstract

The aim of this study was to evaluate the chemical composition, physicochemical and sensory properties of frozen shark steaks purchased at a fish shop. The research material was blue shark (*Prionace glauca*) meat. For the research were used 18 deep-frozen (–18°C) glazed (5%) steaks with a total weight of 3.25 kg, which were purchased from a store specializing in fish sales. Steak samples were thawed in a Frost chilling chamber at 4±1°C and 85% relative humidity for 24 h. Quantitative and qualitative analyses included determination of: basic chemical composition, total collagen, energy and TBARS value, ultimate acidity (pH_u), determination of thermal loss, water holding capacity, shear force value and evaluation of sensory properties. In addition, chroma (C*) and hue (h°) of muscle tissue were calculated from colour measurements (L*, a*, b*).

From the data obtained, shark meat after thawing was characterized by a high protein and ash content and a low share of fat, which corresponded to a low calorific value. The total collagen content was low at 0.14 mg/g and the TBARS value was 0.941 mg MDA/kg meat. In relation of physicochemical properties, shark steaks were characterized by high pH_u value after thawing, as well as high cooking loss, low shear force value and low water holding capacity. The colour of the muscle

tissue of the analyzed samples was definitely light, as proved by a high parameter value (L*) of mean: 57.79. Shark meat was shown to have a high share of yellow colour and chroma, as well as a shift towards green colour, which was evidenced by the negative values for the a*parameter. For the colour hue, low negative values were recorded with an average (h° = –85.20), confirming the yellowish hue of the meat. In the sensory panel evaluation, the lowest scores of respectively: 4.43 and 4.44 were awarded for the intensity and desirability of meat palatability, while the highest scores were for the intensity and desirability of the aroma and its tenderness, the quality of which was determined to be very good and good.

Keywords: shark, meat, chemical composition, physicochemical and sensory properties.

INTRODUCTION

Fish have been a part of the human diet since ancient times. Several thousand species of fish are used in human nutrition, of which about 350 can be classified as industrial. Fish consumption in individual countries is determined by cultural factors, diet, and consumer habits and traditions [Kapusta 2014; Pieniak et al. 2008]. Fish are one of the most preferred and recommended foods by nutritionists because it is a valuable source of essential fatty acids (including omega-3 and omega-6), complete protein, many minerals, and vitamins [Hantoush et al. 2014; ShaoLing et al. 2019; Usydus et al. 2011]. Fish meat and fish products should be consumed at least twice a week, but in Poland they are still consumed only occasionally, especially during holidays, and mainly sea fish. In addition to sea and freshwater fish, both wild-caught and farmed, imported fish from various exotic species, including sharks, are also available in the country in the form of deep-frozen whole fillets or steaks [Chwastowska-Siwiecka & Bartoszewicz 2023].

Sharks account for a small proportion of the fish species caught worldwide, but despite this fact, they are commonly used due to the versatile and practically comprehensive use of these predators' carcasses. The most respected parts of the shark carcass are the fins and meat, which are components of many dishes and are willingly consumed by people in certain regions of the world, mainly seaside areas [Biery & Pauly 2012]. In many communities, shark meat is consumed in salted,

dried, or smoked form. Dried and salted meat of shark is popular because this method of processing makes it convenient to transport the product to places where it spoils more quickly [Vannuccini 1999; Walker 1998]. In order to obtain shark meat of 'good' quality, the fish should be processed as soon as possible after slaughter. Shark meat should be frozen at –25°C, after which large sharks can be cut into fillets, while small sharks are frozen whole trunk without the head, tail fin, guts, and skin. The taste and quality of the meat and its products depend on effective bleeding, the species of shark and sanitary conditions [Al-Qasmi 1994].

The quality of fish meat, slaughter yield, and chemical composition depend, among other things, on environmental conditions, physiological condition, gender, age, and the season of catching [Guler et al. 2008]. The technological utility of fish, on the other hand, depends on the species, qualitative, and quantitative features, including nutritional value and chemical composition of the meat, as well as the proportion of valuable edible parts [Chwastowska-Siwiecka et al. 2016]. The quality characteristics of shark meat can be affected by both the quality of the raw material and secondary changes that occur as a result of freezing and frozen storage. Although freezing is one of the methods used to preserve food, it can cause negative changes in meat quality directly related to the freezing process and subsequent storage in a frozen state. The frozen state does not completely inhibit the biophysicochemical processes occurring in meat, but only limits or changes their course. During the freezing of raw meat, processes such as post-slaughter maturation are significantly inhibited. However, processes directly or indirectly related to water freezing takes place intensively. The quality and shelf life of frozen meat is mainly limited by oxidative changes in fat, proteolytic, and denaturation of proteins, and weight losses [Chwastowska & Kondratowicz 2007].

In the opinion of consumers, fish quality is a very complex concept, as it consists of a number of factors, the most important of which include: health safety, freshness, overall quality, and nutritional value of the product, as well as the species of fish, size and type of product [Olafsdottir et al. 2004]. There is a lack of information in the national literature on the quality of shark meat available in the retail network. Therefore, research was conducted on frozen blue shark meat to determine its chemical composition, physicochemical parameters, and organoleptic features after thawing.

1. MATERIAL AND METHODS

1.1. Research material

The research material consisted of meat (steaks) obtained from blue shark carcasses (*Prionace glauca*), which, according to the producer's declaration, were caught in the South-East Pacific Ocean (fishing area: FAO 87, fishing gear: LHP rope hooks). The study used 18 deep-frozen (–18°C) steaks covered with glaze (5%) with a total weight of 3.25 kg, which were purchased in a shop specializing in the sale of fish and fish products in the Ełk district, within their shelf life. Immediately after purchase, the steaks were transported in an isothermal portable container at a temperature of –18±1°C and sent for quantitative and qualitative analysis in the laboratory. The steak samples were thawed in a Frost chilling cabinet at a temperature of 4±1°C and relative humidity of 85% for 24 hours. The average weight of the thawed samples was 0.175 kg. Before the chemical and physicochemical analysis, samples were passed through a 3 mm plate in a meat grinder or homogenized using with a IKA Ultra Turrax®T25 homogenizer.

1.2. Laboratory analyzes

The proximate chemical composition of meat samples was determined according to the procedure of AOAC [2016]. Water content was determined by sample drying at a temperature of 105°C to a constant weight. Crude protein content was determined by the Kjeldahl method (Kjeltec™ 2200 Auto Distillation Unit, FOSS Analytical, Hilleroed, Denmark). The conversion factor of 6.25 was used to convert N values to crude protein content. Crude fat content was determined by the Soxhlet method (Soxtec™ 2050 Auto Fat Extraction System, FOSS Analytical, Hilleroed, Denmark). Extraction was performed with diethyl ether as the solvent. Ash content was determined by incineration to a constant weight at 550°C in a muffle furnace. The collagen content of meat was determined based on the hydroxyproline content according to PN-ISO 3496:2000, which was converted into total collagen content using a conversion factor of 7.25 [Palka 1999]. The rate of lipid oxidation was determined in a thiobarbituric-acid-reactive substances (TBARS) assay according to Rak & Morzyk [2002]. Absorbance was measured with the Specord®40 spectrophotometer (Analytik Jena AG, Jena, Germany) at a wavelength of 532 nm.

The TBARS value was expressed as mg of malondialdehyde (MDA) per kg of meat. The energy value of meat was calculated using conversion factors of 16.78 kJ/g (4 kcal) for protein and 37.62 kJ/g (9 kcal) for fat [Jeszka 2010].

The acidity of muscle tissue (grinded sample) was measured in meat homogenates (pH_u) (1:1 m/v ratio of meat to redistilled water) using the 340i pH-meter equipped with the WTW TFK 150/E temperature sensor and a Hamilton Double Pore combination glass electrode. Before measurements, the pH-meter was calibrated against buffers with known pH according to PN-ISO 2917:2001/ Ap1:2002. To determine cooking loss, shark meat samples weighing approximately 50 g were packaged in polyethylene (PE) string bags and pasteurized in a water bath at a temperature of 80°C for 50 minutes. Then the samples were cooled for 30 min under cold running water, dried, and weighed within an accuracy of 0.01 g. Cooking loss (%) was calculated as the difference between sample weights before and after heat treatment [Honikel 1998]. The water-holding capacity of shark meat was determined by the Grau and Hamm method [Oeckel van et al. 1999]. A sample of minced meat (approx. 300 mg) was placed on Whatman filter paper No. 1. and then between two glass plates and subjected to a load of 5 kg for 5 minutes. The meat area and the expressed juice area were outlined and scanned. Both areas were planimetred by computer image analysis using Multi Scan software (Computer Scanning System III, Poland). The difference between the areas, converted to 0.3 g, was a measure of forced drip (higher value – lower water-holding capacity; cm^2). The shark meat samples used for estimating cooking loss were wrapped in aluminum foil, stored at –4±1°C for 24 h, and cut three cubical samples measuring 2 × 2 × 2 cm. The maximum shear force required to cut meat samples across the grain was measured using a Warner-Bratzler head (500 N, speed 100 mm/min.) attached to the INSTRON 5542 universal testing machine (Instron, Canton, Massachusetts). The color of meat was determined based on the values of parameters L*, a*, and b* in the CIELAB color space according to CIE [1978], measured by the reflectance method with the HunterLab MiniScan XE Plus instrument (Hunter Associates Laboratory Inc., Reston, VA, USA), directly at the cross-section of the samples. Each measurement was conducted in triplicate, at the same points (Photo 1), with D65 standard illuminant, 10° observer, and aperture diameter of 2.54 cm. The measurements were performed immediately after thawing the meat at a temperature of –4±1°C. The instrument was calibrated with the use of black and

white standards before each series of measure. Saturation/chroma (C*) (1.1) and hue angle (h°) (1.2) were calculated using the formulas proposed by Hunt et al. [1991]:

$$C^* = \sqrt{(a*)^2 + (b*)^2} \quad (1.1)$$

$$h^\circ = \tan^{-1} \frac{b*}{a*} \quad (1.2)$$

Photo 1. Colour measurements at the cross-section of shark steaks

Source: Chwastowska-Siwiecka & Bartoszewicz 2023.

The sensory properties were assessed on samples to heated in 0.62% NaCl solution (weight ratio of solution to steak sample 2:1) at a temperature of 96°C until the internal temperature of the sample reached 80°C, according to the method Baryłko-Pikielna and Matuszewska [2009]. The analysis involved 5 trained panelists with validated sensory acuity according to standard ISO 8586:2023 who evaluated the following sensory attributes on a 5-point scale extended to include half assessments in accordance with PN-ISO 4121:1998, such as: aroma, tenderness, juiciness, and flavor. The panelists assessed samples in individual compartments. Fluorescent white lights (500 lx) that simulated daylight, installed at a height of approximately 1 m, were used to evenly illuminate the table. Relative minimum air humidity of 60% and temperature of 21°C were maintained in the panel room. Each attribute was graded on a five-point scale, with a relevant quality definition assigned to each grade, where: 1-2.0 points denoted poor quality; 2.1-3.0 points unsatisfactory quality; 3.1-4.0 points satisfactory quality; 4.1-4.50 points good quality; 4.51-5.0 points very good quality.

1.3. Statistical analysis

The obtained results were subjected to statistical analysis, calculating only basic measures: arithmetic mean ($\overline{x}$) and standard deviation (±SD) using Statistica software version 13.3. [StatSoft 2017].

2. RESULTS

In order to comprehensively and objectively assess the nutritional value of blue shark meat, its basic chemical composition, energy value and TBARS were analyzed, and the results are presented in Table 1. In the present study, it was found that the moisture content of the meat was quite low compared to the results obtained by other authors, while the total protein content was at a similar level. The results of the present study data indicate that the total collagen share in 1 g of fresh tissue was low. The samples were found to have a low fat content and high amount of mineral compounds in the form of ash, as shown in Table 1. According to the Polish Standard PN-A-86770:1999, the fat content in muscles of up to 2% qualifies meat from blue shark as lean fish. The energy value of blue shark steaks was in the lower range at 390.45 kJ/100 g, with confirming its low calorie. The results presented in Table 1 indicate a low average TBARS value determined by the amount of MDA/kg of meat after thawing. The obtained value parameter confirmed the high oxidative stability of lipids in the analyzed *P. glauca* meat.

Table 1. Chemical composition, energy and TBARS value of shark meat ($\overline{x}$±SD)

Specification	Steaks (n = 18)
Moisture [%]	58.45 ±1.03
Protein [%]	22.90 ±0.97
Fat [%]	0.16 ±0.03
Ash [%]	1.29 ±0.11
Total collagen [mg/g fresh tissue]	0.14 ±0.06
Energy value [kcal/kJ/100 g]	93.08 ±0.98/390.42 ±2.70
TBARS value [mg malondialdehyde/kg of meat]	0.941 ±0.26

Source: own study.

In own research (Table 2), blue shark steaks after thawing were characterized by a high ultimate acidity value (pH_u) measured in a water homogenate. An extremely important quality feature affecting the subsequent processing suitability of raw materials is drip loss, cooking loss, and water holding capacity. Significant cooking loss of weight and low capacity to retain own and added water were observed, which was confirmed by the high water holding capacity value. Although, it can be concluded that the hydration status of the tissue, determined by the specified leakage, indicated good quality of the thawed blue shark muscles. In the current study, compiled in Table 2, it was shown that the steaks were characterized by high tenderness, as demonstrated by the low shear force value, which also indicated that the meat was soft and delicate. The average values obtained for the color parameters of shark steaks, make it possible to characterize them as a raw material with a relatively light color with a high proportion of yellowness pigment b*, which also corresponds to a low a* parameter value, as show in Table 2. The light color of this meat is a natural phenomenon resulting from a higher amount of white fibres and a low amount of myoglobin in the muscle tissue of these fish. In the case of the redness color components, it was noted that the average value of this parameter was negative (-a*), which indicates a shift in the color spectrum towards green. It was shown that shark meat had a high saturation value of C*, while the yellowish hue was confirmed by a negative color tone value, which was (h° = –85.20).

Table 2. Selected physicochemical properties of shark meat ($\bar{x}$±SD)

Specification	Steaks (n=18)
$pH_{ultimate}$ after thawing	6.58± 0.19
Water holding capacity [cm^2]	8.78± 0.43
Cooking loss [%]	39.96± 0.94
Shear force value (N)	6.93 ±0.82
L* – colour lightness	57.79 ±0.87
a* – colour redness	–0.11 ±1.12
b* – colour yellowness	28.89 ±1.16
C* – chroma saturation	29.04 ± 0.89
h° – hue angle	–85.20 ± 1.20

Source: own study.

The scores obtained in the study, characterizing the sensory quality of thawed shark steaks, are presented in Table 3. In the organoleptic assessment, the analyzed meat samples obtained scores levels from 4.43 to 4.96 points for all quality features, which confirms that the meat had very good and good quality. The based on the data obtained, the highest scores were confirmed for the intensity and desirability of aroma of this meat, reaching nearly 5 points. In the sensory panel's assessment, the lowest scores were given for intensity and desirability of flavor, which means that their quality was at a good level, as shown in Table 3. The meat of the blue shark was characterized by the desired tenderness and juiciness, which was confirmed by high scores for these attributes, defining its quality as very good and good. The tested samples of shark meat demonstrate specific attributes characteristic of the species, namely, the meat is very tender, lean, and uniquely flavorful. In addition, it has less of its own aroma (with a noticeable buttery note) and a flavor reminding of a combination of meat of tuna and poultry meat with a noticeable buttery taste, as well as a delicate and tender texture. It should be remembered that after slaughtering a shark, urea is very easily converted into ammonia, which gives the meat a strong, undesirable aroma, and an ammoniacal taste that is noticeable in fresh meat. Depending on the taxonomic group, shark meat can be varied, namely ranging from tender and white to hard and dark.

Table 3. Organoleptic assessment of shark meat ($\bar{x}$ ± SD)

Specification	Steaks (n = 18)
Aroma – intensity (points)	4.96 ±0.10
Aroma – desirability (points)	4.93 ±0.12
Juiciness (points)	4.49 ±0.33
Tenderness (points)	4.53 ±0.30
Flavor – intensity (points)	4.43 ±0.48
Flavor – desirability (points)	4.44 ±0.46

Source: own study.

3. DISCUSSION

According to research by Bosch [2012], the meat of the grey smooth-hound shark had a water content of 74.90%, total protein of 23.41%, fat of 1.59% and mineral compounds in the form of ash of 1.43%. Kim et al. [2008] conducted research to determine the chemical composition and physicochemical properties of the meat of two shark species, namely the *Sphyrna zygaena* and the *Isurus oxyrinchus*. In the case of the first shark species, the authors cited showed that in terms of chemical composition, the share of moisture, total protein, fat, and ash in the muscles was 82.48, 17.35, 0.57 and 0.90%, respectively. The muscle tissue of *I. oxyrinchus* was characterized by a lower moisture content (77.78%), higher protein (22.04%), fat (0.72%), and mineral content (1.26%). ShaoLing et al. [2019] reported that the muscles of the *Carcharhinus falciformis* were characterized by a moisture content of 76.67%, fat of nearly 0.50%, and average protein, and ash content of 26.43 and 1.63%, respectively. In the case of blue shark (*P. glauca*), the authors found that the moisture content was higher than in own studies by 19.11%, which was 77.56%. The fat content was also higher, at below 0.50%. The protein content was 1.44% higher than in our own studies, amounting to 24.34%. However, the mineral (ash) content was 1.23%, which was slightly lower than in our own studies by 0.06%. Both shark meat was rich in collagen, and its level was significantly higher in the latter than in the former (0.27% vs. 0.41%). At the same time, the authors showed that the collagen content in the muscles of other fish species is different and ranges, for example, 0.64% in *Dicentrarchus labrax*, 0.87% in *Cyprinus carpio*, and 0.35% in muscle tissue of the *Hypophthalmichthys molitrix*. The nutritional and energy value of meat consists of protein, fat, minerals, vitamins, and carbohydrates. The calorific value of an average portion of fish (100 g) ranges from less than 400 to approximately 1225 kJ [Jeszka 2010]. According to Kapusta [2014], the energy value of lean fish is low, ranging from 60 to 115 kcal/100 g (251-482 kJ/100 g). The TBARS value is an index of secondary lipid oxidation and is expressed as the concentration of malondialdehyde (MDA), which indicates a direct symptom of toxic autooxidation processes [Kamkar et al. 2014]. As reported by Kamkar et al. [2014], fresh fillet *H. molitrix* contains 0.54 mg MDA/kg, while after 30 days of storage at a temperature of –3°C, the TBARS value was 3.75 mg MDA/kg.

Among the physicochemical properties, indicators such as acidity, muscle tissue hydration, color, and tenderness are determined. One of the most important

and critical parameters is pH, which affects the technological properties and spoilage of food. In addition, acidity has an extremely important role in inhibiting the growth of undesirable bacterial microflora, thus affecting the shelf life of products [Chwastowska-Siwiecka et al. 2016]. Kayim and Can [2010] demonstrated that the typical pH of live fish muscle of the species (*Trachurus trachurus*) is approximately 7.0, whereas after slaughter and during the initial storage period, it can reach a pH of 6.2. The same authors noted an increase in pH to 6.5 already in the first week of storage in ice, while in the second week of storage this value was 6.8. Therefore, the authors considered this parameter to be an indicator of fish freshness. According to Kim et al. [2008], the acidity of *S. zygaena* meat was 5.77, while for *I. oxyrinchus* it was 6.06. Kahraman & Berik [2013] in their research on the quality of spiny dog fish (*Squalus acanthias*) meat showed that the average pH value of the fillet was 6.44.

The color of raw materials and meat products is one of the first indicators of quality that consumers pay attention to, and it often influences their purchasing preferences for a certain product [Gozdecka 2006]. The main factors determining the color of meat are muscle pigments, their quantity, composition, and the changes they under go. The color of fish meat is a species-specific feature and depends on the amount of red muscle and the proportion of pigments, i.e., myoglobin, hemoglobin, and carotenoids. The condition of haematine pigments is also important, as oxidation causes them to turn browning [Chwastowska-Siwiecka et al. 2016]. The color of fish muscle tissue depends on the type and intensity of the individual's activity during its lifetime. Since red muscles are used for continuous movement, they contain large amounts of myoglobin, which gives the tissue a redder color. The dominant muscle tissue in most fish species, including sharks, is white muscle, which contains low levels of myoglobin. This is due to the short-term work of these muscles during swimming [Bone 1979]. The muscles of *Carcharhinidae* are mainly composed of white tissue, which is related to the way they move, while red muscle tissue accounts for only a small proportion [Donley & Shadwick 2003]. The meat of *S. zygaena* and *I. oxyrinchus* sharks analyzed by Kim et al. [2008] was characterized by a light color, similar to the meat of *P. glauca* in our own studies. The lightness parameter value for the *S. zygaena* was (L* = 50.18), while for the *I. oxyrinchus* shark lower values were obtained at (L* = 49.23), which indicates a slightly darker color. The muscle tissue of both species analyzed by Kim et al. [2008] was characterized by a lower share of yellow color than in our own research, namely in the case of the *S. zygaena* shark this parameter was (b* = 10.37), and in the muscles of the *I. oxyrinchus*

(b* = 5.21). At the same time, the authors noted that the redness color values of the meat of the two shark species studied were positive, with a significantly higher share of red pigment in the muscle tissue of the *S. zygaena* shark (a* = 3.77) and a lower in the *I. oxyrinchus* (a* = 0.04).

CONCLUSIONS

The results of this study indicate that the shark meat after thawing has high nutritional and dietary value, as evidenced by its high total protein and ash content and low fat content. At the same time, the TBARS values obtained indicate high oxidative stability of intramuscular lipids in steaks fat. In terms of physicochemical properties, it was shown that shark muscle tissue was characterized by high ultimate acidity, lower water holding capacity, significant cooking loss, and desirable tenderness expressed by low shear force. It was found that the samples of shark meat were characterized by a distinct lightness with a yellowish hue, as well as a high proportion of yellow color component. In the organoleptic evaluation, all the meat parameters assessed received high scores indicating very good and good quality. The highest scores were awarded for quality features such as aroma intensity and desirability, while tenderness and juiciness received similar scores, confirming that the meat was definitely soft, and very juicy.

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CONSUMER ATTITUDES AND BEHAVIORS TOWARDS HIGH-PROTEIN BARS

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Abstract

The aim of the study was to assess consumer preferences, expectations, and opinions about various protein bar brands. Regarding increasing popularity and variety of brands and types of this product a CAWI survey was conducted among 318 respondents, mainly young consumers of protein bars. Frequency of protein bars consumption, favorite brands, and flavors of the most frequently consumed protein bars as well as respondents' attention to the composition of these products were investigated. Respondents pay attention to the macronutrients of the bars, the most popular are chocolate and caramel bars, half of the respondents believe that brand and manufacturer influence the composition and quality of bars.

Keywords: consumer preferences, protein bars, consumer attitudes, brands, survey.

INTRODUCTION

Protein bars are becoming increasingly popular, especially among physically active individuals who strive for a healthy diet [Pasiakos et al. 2015]. The introduction of these high-protein snacks into daily eating habits is attracting the attention of both athletes and those seeking to maintain or improve their health. Like traditional energy bars, protein bars are easy to carry and consume on the go, making them a convenient and practical choice for those with an active lifestyle. Protein bars are distinguished by their composition rich in high-quality protein of animal or plant origin, which plays a key role in muscle recovery and growth,

as well as maintaining adequate energy levels [Phillips et al. 2015]. Furthermore, such bars may also contain carbohydrates, fats, fiber, vitamins, minerals, flavorings, and sweeteners. The nutritional value of protein bars may vary depending on the brand and product type [Wardenaar et al. 2017]. Protein bars are designed to provide the body with more protein, which is essential for building and repairing muscle tissue. This can help increase exercise performance and reduce muscle catabolism [Głodek et al. 2012; Jakubiec & Michalczyk 2018; Michalczyk & Czeczotko 2015]. Unlike energy bars, which often have a high glycemic index and provide a quick dose of energy, they can provide a longer-lasting feeling of fullness and prevent sudden spikes in blood sugar [Witard et al. 2016]. High-protein bars can also support weight loss. Due to their low sugar and high protein content, they can help maintain a feeling of fullness and control appetite, contributing to reduced calorie intake [Rybicka & Stolarek 2019]. They are also a healthy alternative to other, less nutritious snacks, which are often high in sugar and fat. For older adults, protein bars can be a convenient source of protein, which is important for maintaining muscle health and preventing the loss of muscle mass associated with aging [Wołoszyn & Wołoszyn-Nowicka 2019]. For vegetarians or vegans, protein bars can be a valuable source of plant protein, helping to supplement the diet with essential amino acids [Nowak et al. 2017].

Protein bars come in several varieties, each with its own distinctive features and ingredients. Milk-based protein bars are one of the most common types of protein bars. They use protein derived from milk or milk products, such as whey protein concentrate or casein. Milk-based protein bars have good solubility and a tasty, creamy flavor [Czerwińska et al. 2015]. In response to the growing demand for alternative protein sources, plant-based protein bars have appeared on the market. They are intended for people on a plant-based diet or seeking alternatives to animal protein, can contain various plant-based protein sources, such as pea, soy, rice, hemp, or almonds. Additionally, they are often enriched with other nutrients, such as fiber and omega-3 fatty acids. Plant-based protein bars are suitable for people with various dietary preferences and can be a healthy and tasty snack [Gromkowska-Kępka & Kołożyn-Krajewska 2016]. Meat-based protein bars are particularly popular among people who prefer animal protein and are looking for a high-quality source of protein. They can be made from various types of meat, such as beef, chicken, or pork and are often enriched with additional ingredients such as dried fruit, nuts, or spices to provide a variety of flavors. They are an attractive option for people who

want to increase their intake of animal protein in their diet [Kubiszewska et al. 2017]. There are also bars tailored to specific consumer needs available on the market. For example, gluten-free protein bars, suitable for people with gluten intolerance or celiac disease or lactose-free protein bars intended for people with lactose intolerance. Additionally, you can find bars with reduced sugar content or enriched with vitamins and minerals that may meet specific nutritional requirements [Majewska et al. 2018].

There are many types of protein bars offered by various brands on the Polish market. The most popular protein bar brands on the Polish market are presented in Table 1.

Table 1. Most popular protein bar brands on the Polish market

Type of bar	Brand
Milk-based protein bars	WPC, Trec Nutrition, OstroVit, FA Nutrition, Nutrend, Biotech USA, Nutramino, NutVit, Scitec Nutrition
Plant-based protein bars	Weider, Pulsin, Go On, Clif Bar, Nutrend, BioTech USA, The Primal Pantry, Barebells
Meat-based protein bars	Jack Link's, Meat Me, Olimp, Power System, Nutrend
Gluten-free protein bars	Nutramino, Grenade, Barebells, Pulsin, Max Protein, Oh Yeah! Nutrition
Lactose-free protein bars	Nutramino, Barebells, Weider, Grenade, Pulsin, BioTech USA
Low sugar protein bars	Grenade, Barebells, Nutramino, Oh Yeah! Nutrition, Pulsin, Quest Nutrition

Source: own study.

Protein bars are a product that is becoming increasingly popular among various consumer groups, including athletes and fitness enthusiasts, those leading an active lifestyle, those on a weight-loss diet, and consumers seeking a healthy snack.

1. MATERIAL AND METHODS

To examine consumer preferences, expectations, and opinions about various protein bar brands, this study employed a diagnostic survey approach and conducted a survey. A survey questionnaire was developed for this purpose and addressed to

individuals who regularly exercise and consume high-protein bars. The survey was completely anonymous and conducted online (CAWI technique). The research hypotheses were:

1. Protein bar brand influences consumer choice.
2. Consumers believe that protein bars produced by well-known manufacturers have a better composition and taste.
3. Consumer preferences influence the frequency of consuming protein bars with a specific flavor.
4. Product price influences the frequency of consumer purchases of protein bars.
5. Product composition is a key factor influencing protein bar consumers' purchasing decisions.

A total of 318 individuals participated in the survey: 165 women (52%) and 153 men (48%). Table 2 presents the gender and age distribution of the survey participants.

Table 2. Characteristics of the surveyed group of respondents

Variable		Number of indications (n)	[%]
Gender	Female	165	52
	Male	153	48
Age	Under 25 years old	240	75
	25–40 years old	72	23
	Over 40 years old	6	2

Source: own study.

The study population was dominated by people aged 25 and under, who constituted 75% of the entire sample (Table 2). Another significant group were those aged 25–40, representing 23% of all respondents. The group of individuals aged 40 and over was the smallest, constituting only 2% of the sample. This may indicate that protein bars are mainly consumed by young people, and after the age of 40, interest in such snacks decreases.

2. RESULTS AND DISCUSSION

The questionnaire included the question: 'Do you pay attention to the macronutrient composition of the products you eat?', to which more than half of the respondents (55%) answered that they pay attention to the macronutrient composition of the products they eat, a quarter (25%) do not pay much attention to it, and 14% indicated that they do not pay attention to it at all. Only 7% of the respondents indicated that their attention depends on the current training cycle (Table 3). It can be stated that the majority of the surveyed respondents were aware of and paid attention to the macronutrient composition of the products they consumed, although there is also a group of people who did not pay much attention to this aspect.

Table 3. Respondents' attention to the macronutrients of consumed products

Type of answer	Number of indications (n)	[%]
Yes, I do care	174	55
I don't pay much attention to it	78	25
No, I don't care	45	14
It depends on the training cycle	21	7

Source: own study.

Based on respondents' responses regarding the frequency of supplementing their diet with protein (Table 4) using supplements (protein powders, protein bars, ready-made high-protein product mixes), it can be concluded that the largest group of respondents, 102 (32%), supplemented their diet with protein supplements less frequently than once every few weeks. This indicates this was not a frequent practice in their daily menus, and maybe they more often reached for protein in other forms. Another significant group of 93 (29%) used protein supplements 'several times a week'. This suggests that although this was not a daily practice, it was still relatively common. Only 48 respondents declared that they supplemented protein 'daily', indicating regular consumption of protein supplements in their diet (15%). Only 48 consumers (14%) used protein supplements 'once a week'. This may be the result of occasional supplement use. The smallest group of 30 individuals used protein

supplements least frequently, only 'once every few weeks' (9%). Therefore, it can be concluded that supplementing their diet with protein supplements was relatively common among the study participants, with a significant number of individuals using these supplements regularly. However, it is also important to note that there were also individuals who did not use protein supplements regularly or did so only occasionally.

Table 4. Frequency of protein supplements consumption

Type of answer	Number of indications (n)	[%]
Less than once every few weeks	102	32
Several times a week	93	29
Every day	48	15
Once a week	45	14
Once every few weeks	30	9

Source: own study.

Analyzing the results regarding the preferences (Table 5) for the manufacturers of bars consumed by respondents, it was found that GoON was the most frequently chosen manufacturer of bars, accounting for 38% of the total. This means that GoON was highly recognized among respondents. The next most popular manufacturer was Allnutrition, whose bars were consumed by 28% of respondents. This is also a significant percentage and suggests that this company has a strong market position. 14% of respondents selected 'other' manufacturer, meaning various companies not mentioned in the questionnaire. This category can be diverse and may include lesser-known brands. Sante was chosen by 8% of respondents, indicating that it has a place in the market, but was less popular compared to GoON and Allnutrition. Olimp achieved a similar result, chosen by 7% of respondents. BioTech was chosen by only two respondents, making it a relatively unpopular manufacturer among the respondents, similar to Trec (2%) and Nutrend (1%). The study highlighted two producers of protein bars – GoON and Allnutrition.

Table 5. Brands of the most frequently consumed protein bars

Brand	Number of indications (n)	[%]
GoON	120	38
Allnutrition	90	28
Other	45	14
Sante	24	8
Olimp	21	7
BioTech	9	3
Trec	6	2
Nutrend	3	1

Source: own study.

Analyzing the survey's responses to the question about favorite protein bar flavors (Table 6), the most popular were: chocolate, which was chosen by 39% of the respondents, caramel (21%), and vanilla, which was almost as popular as caramel (20%). Coconut was less popular, only 16% of the respondents declared it was their favorite taste. The 'other' category was selected by 5% of respondents. This category could include various flavors not included in the survey.

Table 6. Favorite protein bar flavors indicated by respondents

Flavor	Number of indications (n)	[%]
Chocolate	123	39
Caramel	66	21
Vanilla	63	20
Coconut	51	16
Other	15	5

Source: own study.

The factors that influenced the respondents when choosing protein bars in the survey are presented in Table 7. The most important factor influencing the choice of protein bars for the respondents was the product's composition, selected by 40% of respondents. This indicates that this number of respondents placed a significant importance on the product's content. The taste of protein bars was the second most important factor influencing product choice, 33% of respondents considered taste to be crucial for them, suggesting that taste preferences played a significant role in the selection process. Price was the third most important factor influencing the choice of protein bars – 25% of respondents considered price a key factor in their product choice. This indicates a varied approach to spending on this type of product. Only a few respondents (3%) considered branding to be a factor when choosing protein bars. This means that for most respondents, this was not a primary factor influencing product choice.

Table 7. Factors influencing protein bar purchasing decisions

Factor	Number of indications (n)	[%]
Ingredients	126	40
Taste	105	33
Price	78	25
Brand	9	3

Source: own study.

Respondents were also asked where they purchased protein bars. The results are presented in Table 8. The most popular place to buy high-protein bars were supermarkets, which were indicated by 81% of responses. This means that the majority of respondents preferred shopping in large stores. Online shopping was less popular than brick-and-mortar stores, with 13% of respondents purchasing protein bars online. Only 5% of respondents preferred shopping in stores specializing in sports products, while 3 respondents declared purchasing directly from a protein bar manufacturer's store.

Table 8. Preferences for protein bar purchase locations

Place of purchase	Number of indications (n)	[%]
Supermarket	258	81
Online	42	13
Sports products stores	15	5
Manufacturer's stores	3	1

Source: own study.

Analyzing the responses to the question about their opinion on the relationship between the composition and quality of protein bars and the product brand (Table 9), over half of the respondents (51%) believed that the manufacturer's brand had a significant impact on the composition and quality of protein bars. For this group, the manufacturer was an important factor influencing their product choice, both in terms of composition and quality. 43% of respondents declared that they did not pay much attention to the manufacturer's brand and did not believe it had a significant impact on the composition and quality of protein bars. This suggests that for this group, other factors, such as the declared ingredients on the packaging or taste, were more important. Only a small group of respondents (6%) believed that the manufacturer's brand had no impact on the quality and taste of protein bars.

Table 9. Opinions on the dependence of the composition and quality of bars on the product brand

Opinion	Number of indications (n)	[%]
Yes, I think it matters	162	51
I don't pay much attention to it	138	43
I don't think it affects the quality or taste of the bar	18	6

Source: own study.

Summarizing the survey results, it can be concluded that consumers most often choose protein bars from well-known manufacturers, thus confirming the research hypothesis. The majority of respondents' responses indicated GoON and AllNutrinion, which are very popular among athletes. In addition to brand trust,

consumers also primarily consider ingredients and product availability in supermarkets when choosing protein bars.

The protein bar segment is currently one of the most dynamically developing in the food market. The growing popularity of protein bars among consumers can be attributed to several factors. Growing awareness of a healthy lifestyle and increased interest in physical activity are leading consumers to seek products that can support their nutritional and training goals. Protein bars, as a convenient and practical snack providing a high protein content, have become an attractive option for physically active individuals. Moreover, a growing number of people leading a healthy lifestyle, trying to lose weight, as well as a growing group of vegans and vegetarians, are looking for alternative sources of protein, which contributes to the increase in demand for protein bars [Nowacka et al. 2018].

The market is constantly and dynamically developing in terms of innovation and the introduction of new products. Manufacturers strive to adapt to changing consumer preferences and needs, therefore they continually introduce a variety of bar variants. This includes protein bars based on milk, plants, and meat, as well as gluten-free, lactose-free, and other products tailored to specific dietary needs [Wyrębska et al. 2017]. Innovative flavors, textures, and forms of protein bars are also being introduced to meet diverse consumer preferences [Banaszczak & Białek 2017]. The protein bar market is expected to continue to grow and evolve in the future. There is an increased demand for plant-based products. Due to the growing popularity of plant-based diets, plant-based protein bars are expected to gain popularity. Consumers are seeking alternative plant-based protein sources that are environmentally sustainable and aligned with their values [Górska et al. 2016]. Consumers also value variety and experimentation with new flavors and ingredients in protein bars. Manufacturers are expected to develop new flavor combinations and innovative ingredients to meet consumer expectations [Pietruszka et al. 2017]. The future protein bar market is expected to benefit from innovative technologies such as mobile apps, body parameter monitoring, and personalized meal plans. This will allow consumers to better control their nutrition and achieve their health goals [Górska et al. 2020].

Market behavior can be viewed from two perspectives: the consumer's and the producer's. Before making a purchase, i.e., in the pre-decision phase, the consumer focuses primarily on the possibilities of satisfying their revealed needs, while the producer or seller focuses on the multiple determinants shaping their inclination

to choose a specific good or service. In the actual decision phase, i.e., during the purchase, the consumer focuses on the experience. They are also interested in the channels through which information about themselves and the product and service spreads within the buyer's environment. Consumer behavior in the pre-purchase phase encompasses behaviors related to broadly understood information searches and the allocation of funds for the purchase of goods or services. The main determinants influencing consumer information search as the consumer's marketing environment, environmental conditions, the importance of the product or service to the buyer, the consumer's experience and knowledge, and individual differences [Peter & Olson 2010].

A crucial feature of consumer behavior models is their consideration of the influence of marketing instruments. It should be emphasized that these are not merely models of consumer functioning, they also aim to provide answers to questions about the potential impact of factors such as product, price, brand, point of sale, promotion, etc. These factors are most often independent variables, under the company's control, and significantly influence buyer decisions. A key feature of these models is their predictive nature, which allows for the ultimate prediction of the evolution of purchasing behavior, determined primarily by marketing stimuli as well as variables constituting the buyer's broader environment. It can also be noted that preparing for a purchase involves communication via information about the product or service. This information stems not only from the marketing environment but also from consumer activity. It primarily involves searching for information about products, brands, prices, and points of sale [Lambkin et al. 2001].

Protein bars are a product that is becoming increasingly popular among various consumer groups. Athletes and fitness enthusiasts are among the main consumer groups for protein bars. High protein intake is crucial for muscle development, post-workout recovery, and optimal athletic performance. Protein bars are a practical and convenient source of protein that can be consumed immediately after training or as a supplement to a high-protein diet. Many protein bars available on the market contain ingredients such as branched-chain amino acids (BCAAs) and creatine, which can additionally support regeneration processes and improve physical performance [Szczepańska et al. 2018]. Protein bars have also found their place in the daily menus of people with an active lifestyle. Although these individuals do not necessarily exercise regularly, they value a healthy lifestyle, physical activity, and taking care of their bodies. For them, protein bars provide a convenient and tasty

snack that provides essential nutrients and helps maintain adequate energy levels throughout the day. This allows them to meet their nutritional needs even when they don't have time to prepare a full meal [Nowicka et al. 2019]. Protein bars have also found their way into the diets of people striving for weight loss and a healthy lifestyle. In weight-loss diets, protein plays an important role because it helps maintain a feeling of fullness, increases thermogenesis (the process of burning calories), and supports the maintenance of muscle mass while reducing body fat. Protein bars can be used as a healthy snack, providing not only protein but also other nutrients while limiting sugar and fat [Waśkiewicz et al. 2017]. Finally, protein bars are attracting the attention of people looking for healthy snacks that can satisfy their appetite between meals. Protein bars offer an alternative to traditional energy bars, which are often high in simple sugars and saturated fats. Thanks to their composition, protein bars can be a good source of high-quality protein, fiber, vitamins, and minerals without the added caloric burden. These people appreciate protein bars as a healthier and more satisfying snack that can be part of a balanced diet [Grzeszczak et al. 2018].

Consuming protein bars can offer various health and fitness benefits. Protein bars can provide the body with essential amino acids, which are the building blocks of muscles, tissue, and enzymes [Górska et al. 2016]. Consuming protein bars after a workout or intense physical activity can support muscle building and recovery [Banaszczak et al. 2019]. Consuming protein bars can help maintain a feeling of fullness, which can contribute to appetite control and reduce calorie intake [Rempe & Leidy, 2018]. Protein bars can be a practical solution when we are unable to consume a full meal, providing essential nutrients [Wilczewska et al. 2018]. There are also several potential risks and limitations associated with consuming protein bars. Consuming too much protein can put a strain on the kidneys and lead to nutrient imbalances in the diet [Bilska & Szponar 2019]. Some protein bars may contain excess sugar, fat, artificial sweeteners, or preservatives, which can negatively impact health [Siger et al., 2019]. Protein bars may contain ingredients to which some people are allergic, such as nuts, soy, or gluten [Gromkowska-Kępka et al. 2017].

Safe and effective use of protein bars is ensured by those that contain the simplest and most natural ingredients, limiting artificial additives, and sugars. Protein intake should be monitored and adjusted to individual needs, the recommended daily allowance shouldn't be exceeded. Protein bars should be

included as part of a balanced diet, supplementing them with other protein sources [Tormási et al. 2025].

Customers are constantly looking for healthier snacks that are high in protein, yet low in sugar and fat. The rapid growth of e-commerce is driving growth in protein bar sales. Customers can easily order products online and choose from a wide range of brands and flavors. This allows manufacturers to reach more consumers and expand their market presence. The growing number of people following a vegan or vegetarian diet has created demand for protein bars free of animal-derived ingredients. Protein bar manufacturers are keen to introduce vegan product variants to satisfy this growing consumer group. It's worth noting that the protein bar market is dynamic and subject to change in response to changing consumer trends and preferences.

CONCLUSIONS

Protein bars are a popular food product that is gaining increasing popularity among physically active individuals, athletes, those on weight-loss diets, and other consumer groups. They are a convenient, high-protein snack that can be used both before, during, and after a workout. Protein bars can also support weight loss by providing a feeling of fullness and essential nutrients. There are many types of protein bars, including milk-based, plant-based, and meat-based, as well as those tailored to various dietary preferences, such as gluten-free, lactose-free, and others.

Protein bars can have many benefits and play an important role in the diets of various consumer groups. For athletes and physically active individuals, protein bars can provide essential nutrients and aid in muscle recovery. For those on a weight-loss diet, protein bars can be useful as a healthy snack low in sugar and fat while still providing a feeling of fullness. Protein bars can also be a healthy alternative to traditional snacks, meeting the needs of those seeking healthy foods. The protein bar market has significant growth potential in the coming years. Growing awareness of a healthy lifestyle, growing interest in physical activity, and the growing number of people on weight-loss diets or seeking healthy alternatives to traditional snacks are contributing to the growing demand for protein bars. Manufacturers will focus on innovation, introducing new flavors, ingredients, and forms of protein bars to meet diverse consumer preferences. Greater interest in

plant-based protein bars is also expected, along with the development of technology and personalization in this product category. All hypotheses were verified positively in the study. Based on this research, the following conclusions were drawn:

1. Respondents' attention to the macronutrients of consumed products.
2. Consumers eat protein bars at least once a week, what may be correlated to their sports activity.
3. Both ingredients and flavor influence consumers' choice, the most popular are chocolate and caramel bars.
4. Protein bar brand influences consumer choice but only half of them believe that brand and manufacturer influence the composition and quality of bars.
5. Protein bars are purchased mostly in supermarket.

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