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EVALUATION OF THE AVAILABILITY OF THESE PRODUCTS ON THE POLISH MARKET AND THE KNOWLEDGE OF CONSUMERS ABOUT DRIED FRUIT SNACKS®

Ocena stanu wiedzy konsumentów na temat przekąsek z suszonych owoców i dostępności tych produktów na polskim rynku®

Key words: dried fruit, fruit snacks, dried fruits/vegetables snack market.

The changing lifestyle and the growing awareness of consumers regarding the impact of the daily diet on the health and functioning of the organism lead to some kind of control in the selection of products containing natural bioactive ingredients with pro-health properties. Attention is also paid to the products without the addition of simple sugars and fats with an unfavorable profile. The answer to this type of challenge may be dried fruit or vegetables, which, obtained using various drying techniques, can be eaten as a separate valuable snack. The article presents the results of the evaluation of the availability of dried fruit on the example of selected stores of various sizes and a survey conducted among consumers regarding their knowledge and preferences regarding dried fruit snacks.

Słowa kluczowe: suszone owoce, przekąski z owoców, rynek suszonych przekąsek z owoców /warzyw.

Zmieniający się tryb życia i wzrastająca świadomość konsumentów odnośnie wpływu codziennej diety na zdrowie i funkcjonowanie organizmu, skłaniają do pewnego rodzaju kontroli w wyborze produktów zawierających naturalne składniki bioaktywne o właściwościach prozdrowotnych. Zwraca się też uwagę na produkty bez dodatku cukrów prostych i tłuszczów o niekorzystnym profilu. Odpowiedzią na tego typu wyzwanie mogą okazać się suszone owoce lub warzywa, które otrzymywane z wykorzystaniem różnych technik suszenia mogą być spożywane jako oddzielna wartościowa przekąska. W artykule przedstawiono wyniki oceny dostępności suszy z owoców na przykładzie 5 sklepów o różnej wielkości i ankiety przeprowadzonej wśród konsumentów, odnośnie ich stanu wiedzy i preferencji na temat przekąsek z suszonych owoców.

INTRODUCTION

Fruits and vegetables are an essential component of people's diets. Their chemical composition is very diverse. These raw materials are largely made of water (75–96%), so they are not high in calories. Carbohydrates dominate in the dry matter of fruit and vegetables, but the protein and fat content is quite low. Some fruits and vegetables have the ability to store starch, which is hydrolyzed into simple sugars during maturation. Fruits and vegetables are a very good source of vitamins, fiber, minerals, and compounds with bioactive

potential. For this reason, they affect the proper functioning of the body and maintain health, which is why their consumption is so important [4]. Berries are especially valuable, including strawberries, raspberries, black currants, chokeberry, and cranberry. These fruits are a very good source of many health-promoting compounds, such as vitamins (especially vitamin C), polyphenols, carotenoids, and tocopherols. Many of these compounds show an antioxidant effect, eliminating free radicals that can cause cancer, cardiovascular diseases, and others [8, 19].

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In food technology, drying fruit and vegetables is a very good solution, especially in the case of an overproduction of raw materials or seasonal ones, the consumption of which is very limited throughout the year [14]. Drying fruits and vegetables is a good way to extend their shelf life. This process effectively lowers water activity, which minimizes chemical reactions occurring in the raw material and inhibits the growth of microorganisms, thanks to which even seasonal fruit in an attractive form can be available all year round.

In recent years, there has been an increasing interest in a healthy lifestyle and the quality of consumed food. Poles read labels more often and consciously choose less processed, more natural products, without the so-called artificial additives. For this reason, incl. instead of highly processed snacks, they eat dried fruit or vegetables, as well as whole grain products [3]. Dried fruit and vegetables are very important in food processing. For example, dried fruits are used in the production of confectionery and bakery products, but are also used in various types of desserts and dairy products, and in breakfast cereals. On the Polish market, there are various snacks of dried fruit and vegetables in the form of crispy chips, often with no added sugar. Some companies produce these chips by pre-fortifying them with fruit or vegetable juices. Such treatment, in addition to enriching with natural ingredients, allows for the development of attractive sensory values (color, taste, smell). Packages of about 30 g of these chips are very convenient and can be eaten at work, on travel, or when there is a need for a snack. The share of fruit and vegetables in the production of the so-called “healthy food” is increasing [10, 18].

Dried fruit and vegetables are a source of concentrated nutrients and minerals and, to a large extent, many other health-promoting ingredients. They contain vitamins (A, C, group B) responsible for the proper functioning of the immune system. The content of vitamin C in dried apples is 5-30 mg/100g [20]. They contain magnesium, potassium, calcium, and phosphorus, they are also a source of fiber, which is responsible for the proper functioning of the intestines. The fiber content of prunes is 9.4–14.3%. In addition, dried plums are characterized by a high content of boron, which is responsible for better absorption of calcium, and has a very good effect on the skeletal system [15, 17]. Dried fruit is also a source of polyphenolic compounds showing antioxidant activity, reducing the risk of, among others. cardiovascular and heart diseases. The highest levels of polyphenols can be found in dried dates [16], apricots [5] and dried apples, the content of which is 662–2120 mg/kg, depending on the variety and cultivation method [20]. However, the proportion of carbohydrates in dried fruit is significantly increased compared to that of fresh fruit. For example, their content in fresh plums was about 11.7 g/100 g, and in dried plums about 68.9 g/100 g [17].

About 8,000 tons of dried fruit are produced in Poland annually, mainly apples and plums. This is a small number compared to world production, which is around 2.5 million tonnes. The largest amounts of dried fruit are produced in Turkey, Iran, the USA, Saudi Arabia, and China [6].

The aim of the article is to present the obtained results regarding the availability of dried fruit in selected small and large-format and online stores in Poland and research the knowledge and preferences of consumers about dried fruit snacks.

MATERIALS AND METHODOLOGY

The availability of dried fruit snacks was carried out on the example of 3 physical stores and 2 online stores:

- a local store operating on a franchise basis.
- hypermarket 1,
- hypermarket 2,
- bio food online store,
- online store 2.

The forms and types of selected dried fruit snacks available on the Polish market were presented and the leader in the production of dried fruit was indicated.

A survey on the level of knowledge and preferences of consumers regarding dried fruit snacks was conducted in 2021. A questionnaire consisting of single-choice closed-type questions was prepared, aimed at determining the frequency of consumption and consumer knowledge about the impact of dried fruit snacks on the health and condition of the body, a semi-open question that allowed to distinguish the dried fruit that consumers choose most often, and questions concerning the determination of sociodemographic characteristics (gender, age, place of residence and education). The survey was made available via the website www.docs.google.com on the social networking site Facebook. The study was conducted on a sample of 367 respondents, 78.1% of which were women and 21.9% men. Among the respondents, the largest group were people aged 19–30 (79.7%), living in cities with more than 100,000 inhabitants (50.1%) with secondary (43.5%) or higher (41.8%) education. Thus, it can be concluded that the research group consisted mainly of women aged 19–30, living in large cities, during their studies or shortly after their graduation. The results were analyzed using the descriptive method.

RESULTS AND DISCUSSION

Availability of dried fruit snacks on the Polish market

The dried fruit market in Poland is developing dynamically [12]. Currently, in Poland and in the world, the behavior of “being fit” is observed. More and more consumers pay attention to the quality of the food they eat and understand the need to be physically active. According to Gruszczyńska et al. [7] a pro-health lifestyle is associated with a conscious decision about systematic physical exertion included in the routine of everyday life.

Many consumers choose natural, ecological, and low-processed products from among those available on the market. Increasingly, they buy fresh fruit, including those prepared for immediate consumption, washed, peeled, sliced, and packed in small convenient packages. A very attractive form of the recommended snacks is dried fruit or vegetables. And because of life “on the run”, they are eagerly eaten as a quick snack that gives you a feeling of satiety [3].

Currently, dried fruit is sold on the market in the form of:

- in bulk, by weight – the price is given for 1 kg, individually for each species,

- in packages of several or several dozen pieces – dried fruit is packed in 15 g – 1kg grammages, and in 15–100 g grammages are mainly freeze-dried fruit,
- on trays – dried fruit placed on trays,
- in a tube – usually mixes of freeze-dried fruit in the grammage of 70–150 g are sold.

Table 1. List of dried fruit offered by selected stores in Poland
Tabela 1. Zestawienie suszonych owoców oferowanych przez wybrane sklepy w Polsce

Dried fruit	Store type				
	Local store	Hiper-market 1	Hiper-market 2	Bio food online store	Online store 2
Plums	1	6	5	3	
Apricots	1	4	5	2	
Raisins	1	5	5	2	9
Cranberries	1	4	5	2	7
Bananas	1		3	2	
Strawberries	1				
Blueberries		1			
Goji berries		1	4	1	
Figs			2	2	
Quince			1		
Cherries			1	1	
Apples			1	2	
„Miechunka”			2		
Dates		3	2	3	6
Pineapple		2	3	2	
„Hawajka” mix		2			
Christmas Eve mix				1	
Pears				1	
Raspberries				2	
Mango		1	1	1	
Total dried fruit	6	21	40	27	22

Source: The own study

Źródło: Opracowanie własne

Analyzing the availability of dried fruit on the Polish market, the store with the highest supply of dried fruit was hypermarket 1 (large-format store), where the number of products discussed in this study was 40 (Tab. 1). The hypermarket 2 store had 21 products, although, like hypermarket 1, it was a large-format store. The first online store, offering organic products with bio certification, had 27 dried fruits, and the second had 22. The lowest, only 6 dried fruits, was offered by a local, chain store. Raisins and dried cranberries were found to be the most available snacks on the

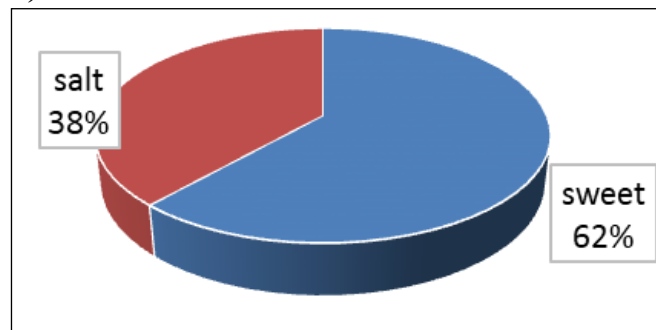
market, as these fruits were in every store, and as the store size decreased, its assortment also decreased. It can be concluded that some types of dried snacks are still not available in smaller stores and may be difficult for consumers to find.

The Polish market for dried fruit snacks is quite significant, smaller in the case of vegetables. There are many companies that produce dried fruit, incl. Bakalland brand, offering 21 dried fruit snacks in the stores analyzed, as well as Makar, Denver Food, Bakal, Helio, Kresto, and hypermarket brands.

Results of the survey on the assessment of consumer knowledge and preferences

The results of the study clearly show that consumers are more likely to eat sweet snacks (62%), and less often salty (38%) (Fig. 1a). Moreover, the vast majority of respondents (85%) declared that they prefer fruit snacks, and the remaining respondents (15%) had vegetable snacks (Fig. 1b).

a)



b)

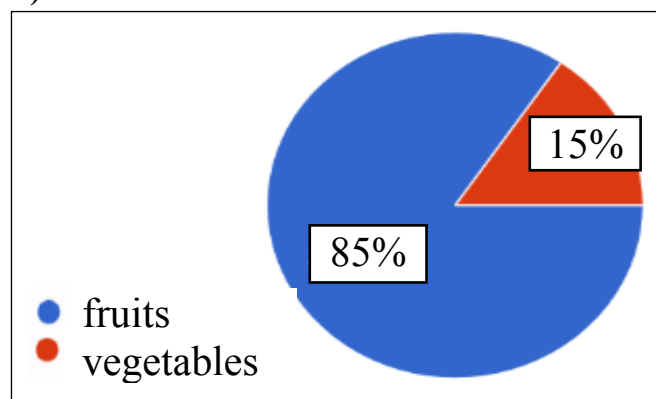


Fig. 1. List of respondents' answers to the question: a) "Do you choose salty or sweet snacks more often?"; b) regarding the declaration of selection of salty or sweet snacks.

Rys. 1. Zestawienie wyników odpowiedzi respondentów na pytanie: a) „Czy częściej wybiera Pan/Pani przekąski słone, czy słodkie?"; b) odnośnie deklaracji wyboru przekąsek słonych lub słodkich.

Source: The own study

Źródło: Opracowanie własne

The vast majority, as many as 85%, stated that they prefer fruit snacks, and only 15% prefer vegetable snacks (Fig. 1). When asked whether the respondents consume dried fruit snacks, more than half of the respondents (62%) answered in the affirmative.

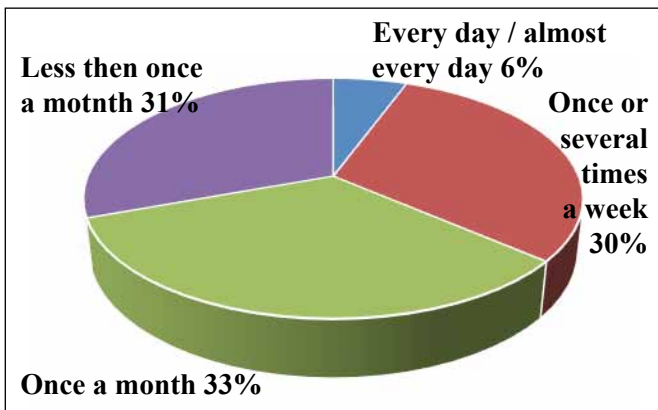


Fig. 2. List of respondents' answers regarding the frequency of consumption of dried fruit snacks.

Rys. 2. Zestawienie wyników odpowiedzi respondentów dotyczące częstotliwości spożycia przekąsek z suszonych owoców.

Source: The own study

Źródło: Opracowanie własne

The next question was to determine the frequency of consumption of dried fruit snacks among people who eat them (Fig. 2). Research has shown that about 33% of respondents eat snacks in the form of dried fruit once a month, and 30% of respondents eat them once or several times a week. A large number of respondents (31%) declared that they choose them less frequently than once a month. By contrast, only 6% buy dried fruit snacks every day or almost every day.

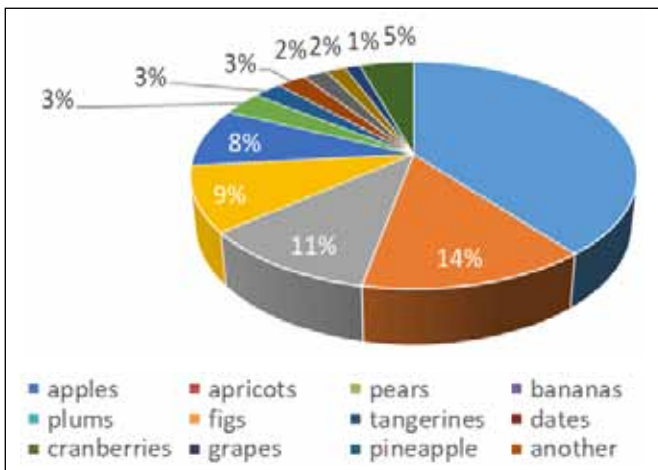


Fig. 3. List of respondents' answers regarding the preferences of the respondents regarding the type of dried fruit most often consumed.

Rys. 3. Zestawienie wyników odpowiedzi dotyczących preferencji ankietowanych odnośnie rodzaju najczęściej spożywanego suszonego owocu.

Source: The own study

Źródło: Opracowanie własne

The respondents were also asked about their preferences regarding the type of the most chosen dried fruit snacks. Most respondents (39%) indicated that they eat dried apples, a smaller number of respondents (14%) declared that they are eager to eat dried apricots, 11% of respondents chose pears, 9% bananas, and 8% plums. The remaining responses concerned such dried fruits as figs (3%), mandarins (2%),

dates (2%), cranberries (2%), grapes (2%), pineapple (1%). The respondents also indicated other answers, including raspberries, strawberries, blueberries, mangoes, and cherries.

Another question was to indicate how often consumers read the information on the package when purchasing dried fruit snacks (Fig. 4). Most respondents, 33%, usually do it, 22% with each purchase, and 22% from time to time. Almost every fourth person (23%) declared that they did not check the information on the packaging before purchasing this type of product. It can be concluded that every third person makes an informed decision about dried fruit snacks with every purchase.

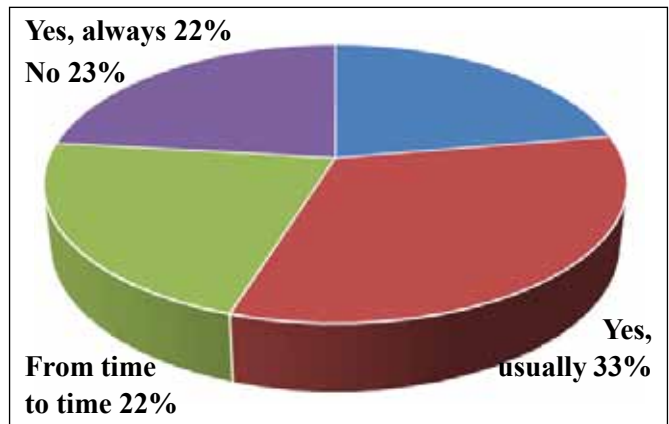


Fig. 4. List of respondents' answers to the question: "When buying dried fruit snacks, do you pay attention to the information on the packaging?"

Rys. 4. Zestawienie wyników odpowiedzi dotyczących pytania: „Czy kupując przekąski z suszonych owoców zwraca Pan/Pani uwagę na informacje zawarte na opakowaniu?”

Source: The own study

Źródło: Opracowanie własne

A large number of people, 21%, strongly agree with the statement that dried fruit snacks are appropriate for maintaining health (Fig. 5), 44% of respondents rather agree, and 21% of respondents are not sure what the health and safety of dried fruit snacks, while quite a few people (around 6%) disagree or strongly disagree (around 6%) with this view.

Assessing consumers' knowledge of the impact of fruit drying on calorific value and sugar content (Fig. 6a), a significant number, 52%, showed that dried fruit contained more calories and sugar compared to fresh fruit, 27% found that drying fruit does not significantly affect the content of nutrients and vitamins and therefore their composition is similar to that of fresh fruit. A significant number of people indicated that dried fruit has less calories and sugar compared to fresh fruit. To test the understanding of the meaning of drying and to compare the calorific value of fresh and dried fruit, a short task was included in the questionnaire (Fig. 6b). The idea was to indicate in which case the same portion (1 cup) of pitted apricot fruit, fresh or dried, contains more calories. The vast majority of respondents indicated dried fruit as the more calorific and richer in sugar. Unfortunately, among the respondents who selected fresh apricots, about 50% believe that the drying process reduces the nutritional and caloric value of these fruits. Fresh fruit contains 85-95% water, which makes it relatively low in

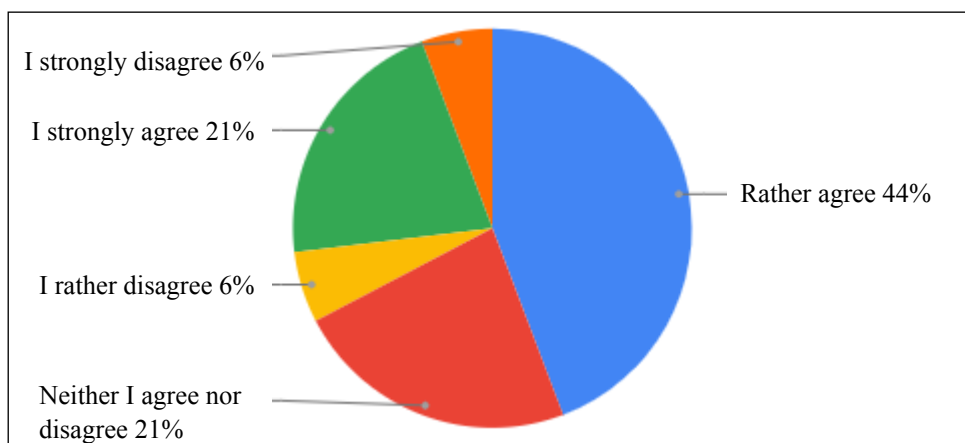


Fig. 5. List of respondents' answers to the question: "To what extent do you think that such dried fruit snacks are "healthy" and safe for the human body?"

Rys. 5. Zestawienie wyników odpowiedzi dotyczących pytania: „W jakim stopniu uważa Pan/Pani, że takie przekąski z suszonych owoców są „zdrowe” i bezpieczne dla organizmu człowieka?”.

Source: The own study

Źródło: Opracowanie własne

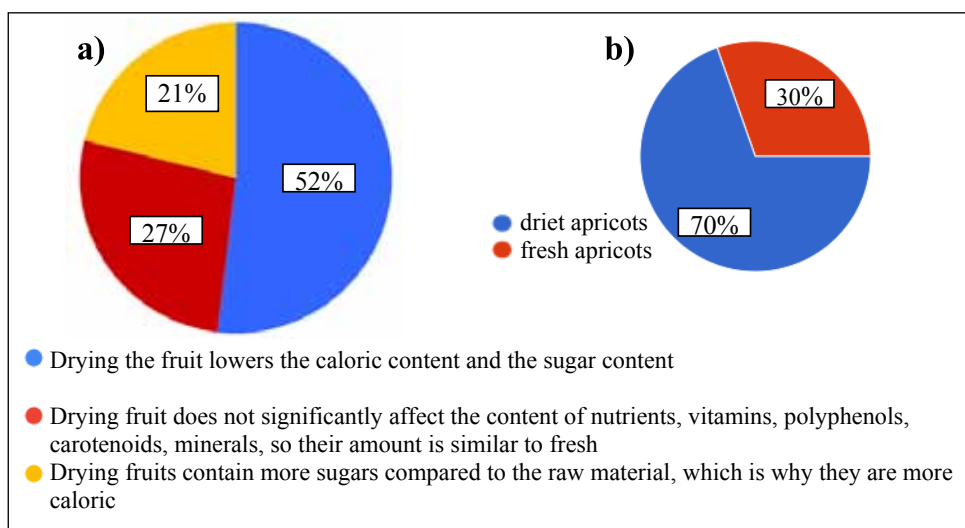


Fig. 6. List of respondents' answers regarding: a) the impact of fruit drying on its caloric value and sugar content, and b) indications which fruit from fresh and dried apricots (the same portions, 1 cup) are more caloric.

Rys. 6. Zestawienie odpowiedzi ankietowanych odnośnie a) wpływu suszenia owoców na ich kaloryczność i zawartość cukru oraz b) wskazania, które owoce spośród moreli świeżych i suszonych (taka sama porcja, 1 szklanka), są bardziej kaloryczne.

Source: The own study

Źródło: Opracowanie własne

calories. According to the tabular data [11], the caloric value of 100 g of fresh apricots is about 48 kcal, while there is much less water in dried apricots, and the caloric value increases to about 240 kcal. Fruit drying significantly increases the content of many ingredients, especially sugars [17]. Currently, various methods of drying fruits and vegetables are used in the food industry, but convection drying is probably still the dominant one. Each of the methods has a more or less destructive effect on the sensory characteristics and quality of the dried material. As has been stated many times, obtaining high-quality

dried material requires the selection of an appropriate method and conditions of drying [9]. Drying methods using reduced pressure are particularly noteworthy, as they allow for effective drying at a temperature lower than at atmospheric pressure. Freeze drying, due to the long process time, is considered a method generating high costs, but the products obtained by this method are especially valued, mainly due to the significant preservation of natural food ingredients [14]. It is possible under appropriate process conditions. By using the elevated temperature, the process time can be reduced, but the quality of such droughts can be degraded. Many producers use hybrid drying, assisted by microwaves. This method, due to the much shorter drying time, compared to other methods, affects energy savings and high product quality, comparable to freeze-drying. The combination of reduced pressure and the effect of microwaves increases the drying efficiency and the possibility of producing attractive droughts and requires a lower energy demand [1, 2, 14].

When assessing whether the respondents are able to accept fruit and vegetable snacks of a different color (Fig. 7a) or taste than the raw material (Fig. 7b), the majority of respondents (55–60%) answered yes, approximately 19% of the respondents did not she was sure, while 21–26% expressed the opinion that they did not like it. Snacks, e.g. pre-enriched in juice (juice concentrate), have appeared on the Polish market. In this way, it is possible to advantageously modify the taste and aroma of red beet or carrot chips or to impart new characteristics, e.g. red apple chips, which have been obtained

by pre-concentrating chokeberry or red beet juice.

Initial osmotic dehydration in fruit juices or concentrates in combination with innovative drying methods allows for to elimination of color changes and even enrichment with bio-components (natural antioxidants, organic acids, vitamins, minerals, and others) and thus increasing the attractiveness of the obtained dried products [13].

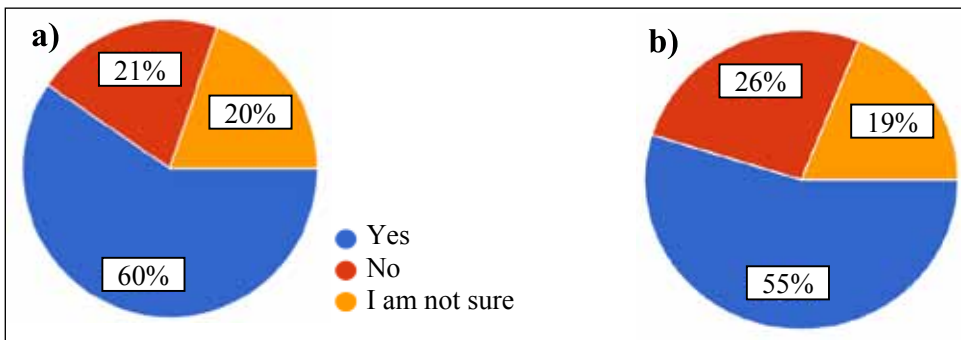


Fig. 7. List of respondents' answers to the question regarding: a) the acceptance of fruit or vegetable snacks with a color other than the raw material, b) with a taste other than the raw material.

Rys. 7. Zestawienie odpowiedzi ankietowanych na pytanie dotyczące: a) akceptacji przekąsek owocowych lub warzywnych o innej barwie, niż surowiec, b) o innym smaku, niż surowiec.

Source: The own study

Źródło: Opracowanie własne

CONCLUSIONS

When assessing the availability of dried fruit on the Polish market, it can be concluded that this market is gradually developing. Large-format stores (hypermarkets) offer a much wider range of such products, compared to smaller stores, the so-called housing estates. Online stores have a wide range of dried fruit, but stores are strictly focused on selling the so-called "Healthy" or "bio" products. Dried fruits are often sold in small packages (a portion to be eaten), in trays, or in tubes.

There are many producers of fruit and vegetable snacks on the market, some companies offer a large variety of this type of assortment. It can be said that these are brands with traditions, observing the needs and preferences of consumers, which is why they introduce more and more attractive snacks.

People taking part in the survey, mainly women and people aged 19-30, are consumers who are aware of the quality of the products they buy. About 55% of respondents showed that they read the product label before buying. Over 65% (some of whom chose the answer "I rather agree") know about the health-promoting properties of dried fruit and vegetables. They are also knowledgeable (about 52%) about the increased caloric content and sugar content of dried snacks, especially fruit, compared to fresh snacks. They prefer sweet snacks (about 62%), and more often eat dried fruit than vegetables, usually once a month or several times a week. Their favorite foods are apples, apricots, and pears. When asked if they would be interested in fruit snacks with a different taste and color

than the raw material, more than half of the respondents answered in the affirmative. Fewer people (19%) admitted that they would not be interested in such a product.

WNIOSKI

Oceniając dostępność suszonych owoców na polskim rynku można stwierdzić, że rynek ten sukcesywnie się rozwija. Sklepy wielkopowierzchniowe (hipermarkety) oferują znacznie większy zakres takich produktów, w porównaniu z mniejszymi sklepami tzw. osiedlowymi. Sklepy internetowe mają bogaty asortyment suszonych owoców, ale dominują sklepy strictly ukierunkowane na sprzedaż tzw. „zdrowych” lub „bio” produktów. Suszone owoce często sprzedawane są w małych opakowaniach (porcja do zjedzenia), na tackach lub w tubach.

Na rynku występuje wielu producentów przekąsek z owoców i warzyw, niektóre firmy oferują dużą różnorodność tego typu asortymentu. Można stwierdzić, że są to marki z tradycjami, obserwujące potrzeby i preferencje konsumentów, dlatego wprowadzają coraz bardziej atrakcyjne przekąski.

Osoby biorące udział w ankiecie, głównie kobiety i osoby w wieku 19-30 lat, to konsumenci świadomi jakości kupowanych produktów. Około 55% respondentów wykazało, że przed zakupem czyta etykietę produktu. Powyżej 65% (w tym niektórzy wybrali odpowiedź „raczej się zgadzam”), wie o prozdrowotnych właściwości suszonych owoców i warzyw. Posiadają także wiedzę (około 52%) na temat zwiększonej kaloryczności i zawartości cukru suszonych przekąsek, zwłaszcza z owoców, w porównaniu do świeżych. Preferują przekąski słodkie (około 62%), częściej sięgają po suszone owoce, niż warzywa, przeważnie raz w miesiącu lub kilka razy w tygodniu. Najchętniej lubią spożywać jabłka, morele i gruszki. Na pytanie, czy byłiby zainteresowani przekąskami owocowymi o innym smaku i barwie, niż surowiec, ponad połowa ankietowanych odpowiedziała twierdząco. Mniej osób (19%) przyznała, że nie byłaby zainteresowana takim produktem.

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REFERENCES

- [1] CUI Z., C. LI, C. SONG, Y. SONG. 2008. "Combined microwave-vacuum and freeze-drying of carrot and apple chips". *Drying Technology* 26: 1517-1523.

REFERENCES

- [1] CUI Z., C. LI, C. SONG, Y. SONG. 2008. "Combined microwave-vacuum and freeze-drying of carrot and apple chips". *Drying Technology* 26: 1517-1523.

- [2] **DE BRUIJN J., F. RIVAS, Y. RODRIGUEZ, C. LOYOLA, A. FLORES, P. MELIN, R. BORQUEZ. 2016.** „Effect of vacuum microwave drying on the quality and storage stability of strawberries”. *Journal of Food Processing and Preservation* 40: 1104–1115.
- [3] **DEJNAKA A. 2019.** „Sposoby odżywiania się przez konsumentów – nowe trendy”. E-Wydawnictwo. Prawnicza i Ekonomiczna Biblioteka Cyfrowa. Wydział Prawa, Administracji i Ekonomii Uniwersytetu Wrocławskiego: 97–110.
- [4] **DOMIN M., A. GRĄDZKA, F. KLUZA. 2015.** „Doświadczalna ocena twardości liofilizatów truskawek”. *Technica Agraria- Acta Scientiarum Polonorum* 3–4(14): 41–51.
- [5] **DRUŻYŃSKA B., I. STRZECHA, R. WOŁOSIAK R. 2008.** „Zawartość wybranych związków biologicznie aktywnych w ekstraktach z suszonych moreli oraz ich właściwości przeciwutleniające”. *Żywność. Nauka. Technologia. Jakość* 6(61): 77–87.
- [6] **DZIECIELAK K. „Owoce suszone. Wszystko, co powinieneś o nich wiedzieć, aby wyszły Ci na zdrowie”.** <https://dietetycy.org.pl/owoce-suszone/>
- [7] **GRUSZCZYŃSKA M., M. BAK-SOSNOWSKA, R. PLINTA. 2015.** „Zachowania zdrowotne jako istotny element aktywności życiowej człowieka. Stosunek Polaków do własnego zdrowia”. *Hygeia Public Health* 50(4): 558–565.
- [8] **GRYSZCZYŃSKA B., M. BUDZYŃ. 2011.** „Aktywność przeciwutleniająca wybranych owoców jagodowych”. *Postępy Fitoterapii* 4: 265–274.
- [9] **IGNACZAK A., A. SALAMON, J. KOWALSKA, H. KOWALSKA. 2022.** „Methods of drying food with the use of reduced pressure” W druku.
- [10] **INTERNET 1.** <http://www.food-info.net/pl/colour/enzymaticbrowning.htm> 08.03.2022.
- [11] **INTERNET 2.** <https://www.odzywianie.info.pl/przydatne-informacje/artykuly/art,Morele-i-suszone-morele-ciekawostki-i-wartosci-odzywcze.html> Dostęp 08.03.2022.
- [12] **INTERNET 3.** <https://www.portalspozywczy.pl/owoce-warzywa/wiadomosci/rynek-bakalii-paczkowanych-wart-jest-ponad-1-6-mld-zl-i-wciazsie-rozwija,166593.html> Dostęp 08.03.2022.
- [13] **KOWALSKA H, A. MARZEC, J. KOWALSKA, A. CIURZYŃSKA, K. CZAJKOWSKA, J. CICHOWSKA, K. RYBAK, A. LENART. 2017.** “Osmotic dehydration of *Honeoye* strawberries in solutions enriched with natural bioactive molecules”. *LWT – Food Science and Technology* 85: 500–505.
- [14] **KOWALSKA H., A. MARZEC, J. KOWALSKA, U. TRYCH, E. MASIARZ, A. LENART. 2020.** “The use of a hybrid drying method with pre-osmotic treatment in strawberry bio-snack technology”. *International Journal of Food Engineering* 16(1–2): 80318–80319. DOI: [10.1515/ijfe-2018-0318](https://doi.org/10.1515/ijfe-2018-0318).
- [15] **LISIECKA J. 2021.** „Bogactwo suszonych owoców”. *Działkowiec* 2(846): 34–35.
- [2] **DE BRUIJN J., F. RIVAS, Y. RODRIGUEZ, C. LOYOLA, A. FLORES, P. MELIN, R. BORQUEZ. 2016.** „Effect of vacuum microwave drying on the quality and storage stability of strawberries”. *Journal of Food Processing and Preservation* 40: 1104–1115.
- [3] **DEJNAKA A. 2019.** „Sposoby odżywiania się przez konsumentów – nowe trendy”. E-Wydawnictwo. Prawnicza i Ekonomiczna Biblioteka Cyfrowa. Wydział Prawa, Administracji i Ekonomii Uniwersytetu Wrocławskiego: 97–110.
- [4] **DOMIN M., A. GRĄDZKA, F. KLUZA. 2015.** „Doświadczalna ocena twardości liofilizatów truskawek”. *Technica Agraria- Acta Scientiarum Polonorum* 3–4(14): 41–51.
- [5] **DRUŻYŃSKA B., I. STRZECHA, R. WOŁOSIAK R. 2008.** „Zawartość wybranych związków biologicznie aktywnych w ekstraktach z suszonych moreli oraz ich właściwości przeciwutleniające”. *Żywność. Nauka. Technologia. Jakość* 6(61): 77–87.
- [6] **DZIECIELAK K. „Owoce suszone. Wszystko, co powinieneś o nich wiedzieć, aby wyszły Ci na zdrowie”.** <https://dietetycy.org.pl/owoce-suszone/>
- [7] **GRUSZCZYŃSKA M., M. BAK-SOSNOWSKA, R. PLINTA. 2015.** „Zachowania zdrowotne jako istotny element aktywności życiowej człowieka. Stosunek Polaków do własnego zdrowia”. *Hygeia Public Health* 50(4): 558–565.
- [8] **GRYSZCZYŃSKA B., M. BUDZYŃ. 2011.** „Aktywność przeciwutleniająca wybranych owoców jagodowych”. *Postępy Fitoterapii* 4: 265–274.
- [9] **IGNACZAK A., A. SALAMON, J. KOWALSKA, H. KOWALSKA. 2022.** “Methods of dry-ing food with the use of reduced pressure” W druku.
- [10] **INTERNET 1.** <http://www.food-info.net/pl/colour/enzymaticbrowning.htm> 08.03.2022.
- [11] **INTERNET 2.** <https://www.odzywianie.info.pl/przydatne-informacje/artykuly/art,Morele-i-suszone-morele-ciekawostki-i-wartosci-odzywcze.html> Dostęp 08.03.2022.
- [12] **INTERNET 3.** <https://www.portalspozywczy.pl/owoce-warzywa/wiadomosci/rynek-bakalii-paczkowanych-wart-jest-ponad-1-6-mld-zl-i-wciazsie-rozwija,166593.html> Do-step 08.03.2022.
- [13] **KOWALSKA H, A. MARZEC, J. KOWALSKA, A. CIURZYŃSKA, K. CZAJKOWSKA, J. CICHOWSKA, K. RYBAK, A. LENART. 2017.** “Osmotic dehydration of *Honeoye* strawber-ries in solutions enriched with natural bioactive molecules”. *LWT – Food Science and Technology* 85: 500–505.
- [14] **KOWALSKA H., A. MARZEC, J. KOWALSKA, U. TRYCH, E. MASIARZ, A. LENART. 2020.** “The use of a hybrid drying method with pre-osmotic treatment in strawberry bio-snack technology”. *International Journal of Food Engineering* 16(1–2): 80318–80319. DOI: [10.1515/ijfe-2018-0318](https://doi.org/10.1515/ijfe-2018-0318).
- [15] **LISIECKA J. 2021.** „Bogactwo suszonych owoców”. *Działkowiec* 2(846): 34–35.

- [16] **VINSON J. A., L. ZUBIK, P. BOSE, N. SAMMAN, J. PROCH. 2005.** "Dried fruits: Excellent in vitro and in vivo antioxidants". *Journal of the American College of Nutrition* 24(1): 44–50.
- [17] **WALKOWIAK-TOMCZAK D. 2013.** „Zmiany jakościowe śliwek (*Prunus domestica* L.) podczas przechowywania i suszenia oraz ocena właściwości prozdrowotnej suszu”. *Rozprawy Naukowe. Uniwersytet Przyrodniczy w Poznaniu* 450.
- [18] **WICHROWSKA D., K. GOŚCINNA, T. KNAPOWSKI, W. KOZERA. 2016.** „Wpływ metod suszenia na barwę plasterów wybranych odmian jabłek”. W: *Rola procesów technologicznych w kształtowaniu jakości żywności* (red. A. Duda-Chodak, D. Najgebauer-Lejko, I. Drożdż, T. Tarko), Oddział Małopolski Polskiego Towarzystwa Technologów Żywności, Kraków.
- [19] **WITKOWSKA A., E. M. ZUJKO. 2009.** „Aktywność antyoksydacyjna owoców leśnych”. *Bromatologia i Chemia Toksykologiczna* 3(42): 900–903.
- [20] **WOJDYŁO A, J. OSZMIAŃSKI, P. BIELICKI. 2010.** „Zawartość wybranych wyróżników chemicznych w owocach trzech odmian jabłoni z uprawy ekologicznej i konwencjonalnej”. *Journal of Research and Applications in Agricultural Engineering* 55(4): 173–177.

- [16] **VINSON J. A., L. ZUBIK, P. BOSE, N. SAMMAN, J. PROCH. 2005.** „Dried fruits: Excellent in vitro and in vivo antioxidants”. *Journal of the American College of Nutrition* 24(1): 44–50.
- [17] **WALKOWIAK-TOMCZAK D. 2013.** „Zmiany jakościowe śliwek (*Prunus domestica* L.) podczas przechowywania i suszenia oraz ocena właściwości prozdrowotnej suszu”. *Rozprawy Naukowe. Uniwersytet Przyrodniczy w Poznaniu* 450.
- [18] **WICHROWSKA D., K. GOSCINNA, T. KNAPOWSKI, W. KOZERA. 2016.** „Wpływ metod suszenia na barwę plasterów wybranych odmian jabłek”. W: *Rola procesów technologicznych w kształtowaniu jakości żywności* (red. A. Duda-Chodak, D. Najgebauer-Lejko, I. Drożdż, T. Tarko), Oddział Małopolski Polskiego Towarzystwa Technologów Żywności, Kraków.
- [19] **WITKOWSKA A., E. M. ZUJKO. 2009.** „Aktywność antyoksydacyjna owoców leśnych”. *Bromatologia i Chemia Toksykologiczna* 3(42): 900–903.
- [20] **WOJDYŁO A, J. OSZMIANSKI, P. BIELICKI. 2010.** „Zawartość wybranych wyróżników chemicznych w owocach trzech odmian jabłoni z uprawy ekologicznej i konwencjonalnej”. *Journal of Research and Applications in Agricultural Engineering* 55(4): 173–177.