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## TYPES OF LACTOSE-FREE PRODUCTS AND THEIR AVAILABILITY ON THE POLISH MARKET®

### Rodzaje produktów bezlaktozowych i ich dostępność na polskim rynku®

*The article reviews the range of lactose-free products, analyzing the information placed on the label in selected stationary and online stores in Poland. 75 lactose-free dairy products were identified, including pasteurized and UHT milk, natural, drinkable and flavored yoghurt, cream, quark cheese, cottage cheese, ripened cheese, spreadable fats and infant formula. It has been shown that online stores were characterized by greater availability of lactose-free products. Nevertheless, the range of these products in stationary stores is constantly increasing. Among the analyzed groups of lactose-free dairy products, the most easily available products were milk and flavored yoghurt. Cottage cheese and cream were the least available. The most lactose-free products available on the market were produced by the Mlekovita Dairy Cooperative. There were no significant differences in composition and nutritional value between the lactose-free and conventional products. However, the differentiating factor was the price of products, which in the case of lactose-free products was from 4 to even 166% higher than in the case of conventional products. There has also been an increasing availability of alternative products for lactose-free dairy products on the Polish market, i.e. drinks or yoghurts based on vegetable raw materials, as well as products in which lactose-free milk was used as an additive i.e. ice-cream, cakes, chocolate.*

**Key words:** lactose-free products, dairy products, lactose, lactose intolerance.

*W artykule dokonano przeglądu asortymentu produktów bezlaktozowych, analizując informacje umieszczone na etykietach, w wybranych sklepach stacjonarnych i internetowych na terenie Polski. Zidentyfikowano 75 produktów mlecznych bezlaktozowych, wśród których znajdowały się mleka pasteryzowane i UHT, jogurty naturalne, pitne oraz smakowe, śmietany, twarogi, serki wiejskie, sery żółte, tłuszcze do smarowania oraz odżywki dla niemowląt. Wykazano, że większą dostępnością produktów bezlaktozowych cechowały się sklepy internetowe. Niemniej jednak asortyment tych produktów w sklepach stacjonarnych ciągle wzrasta. Wśród analizowanych grup produktów mlecznych bezlaktozowych najłatwiej dostępnymi produktami było mleko oraz jogurty smakowe. Najmniejszą dostępnością cechowały się serki wiejskie i śmietany. Najwięcej dostępnych na rynku produktów bezlaktozowych wyprodukowanych zostało przez Spółdzielnię Mleczarską Mlekovita. Nie wykazano istotnych różnic w składzie oraz wartości odżywczej pomiędzy produktami bezlaktozowymi a konwencjonalnymi. Czynnikiem różnicującym była cena produktów, która w przypadku produktów bezlaktozowych była od 4 do nawet 166% wyższa od konwencjonalnych produktów. Zaobserwowano również, wzrastającą dostępność na polskim rynku produktów alternatywnych dla mlecznych produktów bezlaktozowych, tj. napoi czy jogurtów na bazie surowców roślinnych, jak również produktów, w których zastosowano jako dodatek mleko bez laktozy, tj. lodów, ciast, czekolad.*

**Słowa kluczowe:** produkty bezlaktozowe, produkty mleczne, laktoza, nietolerancja laktozy.

## INTRODUCTION

The problem of lactose intolerance is becoming more and more common both in Poland and in the world. It is influenced by various factors, i.e. ethnicity, gastrointestinal tract history, restriction of milk and milk products consumption, or lack of  $\beta$ -D-galactosidase activity [9]. In Poland, every third person suffers from lactose intolerance [18]. In response to consumer needs, the market for lactose-free products is growing dynamically. In 2015, its global value was USD 6.7 billion, of which 80% was dairy. It is estimated that until 2020, the average annual growth rate of the global lactose-free food market will remain at 6% [15]. Despite the growing problem, in Poland and in the European Union there are no legal regulations in the field of food safety that would contain requirements for labeling food products with information on the absence, low or reduced lactose content [6]. The presence of such provisions would significantly facilitate the marketing of lactose-free products on the market and protect consumers.

**The purpose of this article is to show the availability of lactose-free products on the Polish market and their characteristics.**

## MATERIALS AND METHODS

The research material consisted of the information contained on the labels of lactose-free products and conventional products selected for comparison, as well as the information placed on these products on the websites of stores. Lactose-free products in which milk was used as an additive and not as the main product base or its alternatives were also analysed.

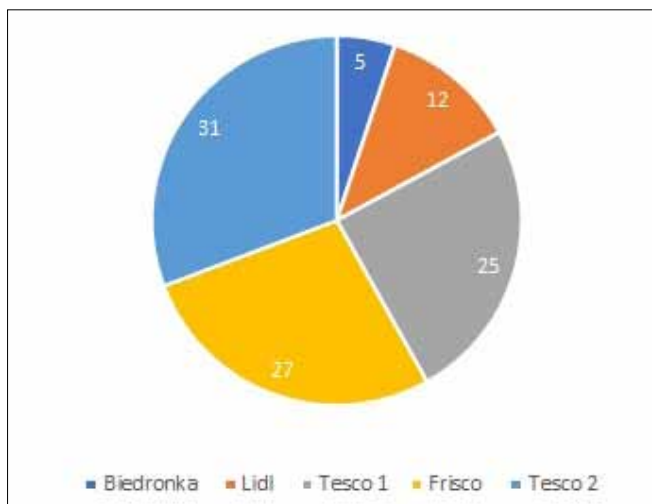
The analysis of the availability of lactose-free products and their characteristics was carried out at the turn of March and April 2019 in online stores: [www.ezakupy.tesco.pl](http://www.ezakupy.tesco.pl), [www.frisco.pl](http://www.frisco.pl) (lactose-free dairy products), [www.koral.com.pl](http://www.koral.com.pl), [www.anita.pl](http://www.anita.pl), [www.tesco.pl](http://www.tesco.pl), [www.guiltfree.pl](http://www.guiltfree.pl), [www.ekologisfood.pl](http://www.ekologisfood.pl), [www.biodyskont.pl](http://www.biodyskont.pl), [www.biozona24.pl](http://www.biozona24.pl), [www.polskikoszyk.pl](http://www.polskikoszyk.pl), [www.zdroweslodycze.pl](http://www.zdroweslodycze.pl), [www.ekosfera24.pl](http://www.ekosfera24.pl), [www.bezgluten.pl](http://www.bezgluten.pl) (other lactose-free products) and stationary stores in the Świętokrzyskie province: discount Lidl in Kielce, Tesco Hypermarket in Kielce and at the discount Biedronka in Włoszczowa.

## RESULTS AND DISCUSSION

### Lactose-free dairy products

75 different lactose-free products were identified in the stores selected for the study (Fig. 1). Some product ranges repeated and appeared in several stores.

Online stores had the largest range of lactose-free products (58% of available products). There were 36 different products (31%) available in the Tesco online store, and 32 products (27%) in the Frisco online store. In the case of stationary stores, as in the case of online stores, the largest range of lactose-free products was in the Tesco stationary store. There were 29 lactose-free dairy products available (25%). The fewest lactose-free products were available in discount stores such as Lidl (12%) and Biedronka (5%).



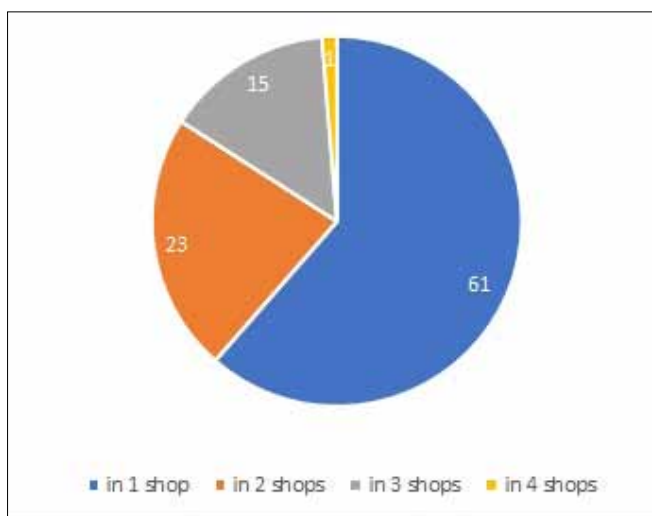
**Fig. 1. Availability of lactose-free products in stationary (Biedronka, Lidl, Tesco 1) and online stores (Frisco, Tesco 2) (%).**

**Rys. 1. Dostępność produktów bezlaktozowych w sklepach stacjonarnych (Biedronka, Lidl, Tesco 1) oraz internetowych (Frisco, Tesco 2) (%).**

Source: Own study

Źródło: Badania własne

Unfortunately, most of this assortment - 61% was available only in individual stores, which was difficult for the consumer to buy all the necessary products in one place (Fig. 2).



**Fig. 2. Availability of lactose-free products in individual stores (%).**

**Rys. 2. Dostępność produktów bezlaktozowych w poszczególnych sklepach (%).**

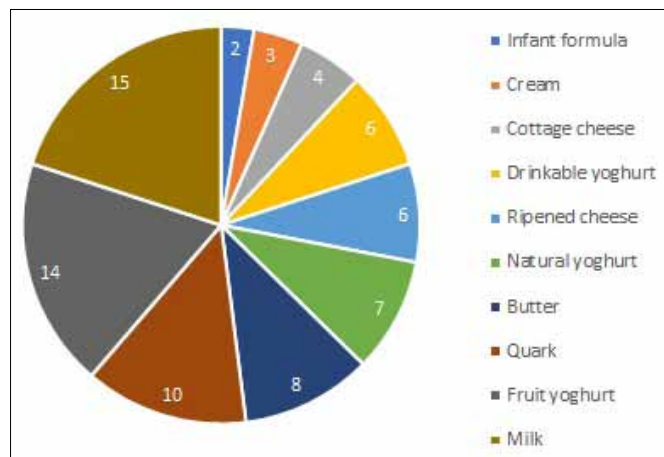
Source: Own study

Źródło: Badania własne

The availability of lactose-free products varied depending on the type and size of the store and this assortment was much more easily available in online stores. Only one product was available in as many as 4 analyzed stores, and it was 2% fatmilk in a bottle of OSM Piątka. However, none of them repeated in all the analyzed stores.

Almost half of the products available in the five analyzed stores could be bought in the Tesco and Frisco online store, and then in the Tesco stationary store. There was the lowest availability of such products in the Biedronka discount store.

Dairy products found in various analyzed stores belong to various assortment groups. Fig. 3 presents the distribution of availability of individual groups of dairy products.



**Fig. 3. Availability of various dairy products in the analyzed stores (%).**

**Rys. 3. Dostępności różnych produktów mleczarskich w analizowanych sklepach (%).**

Source: Own study

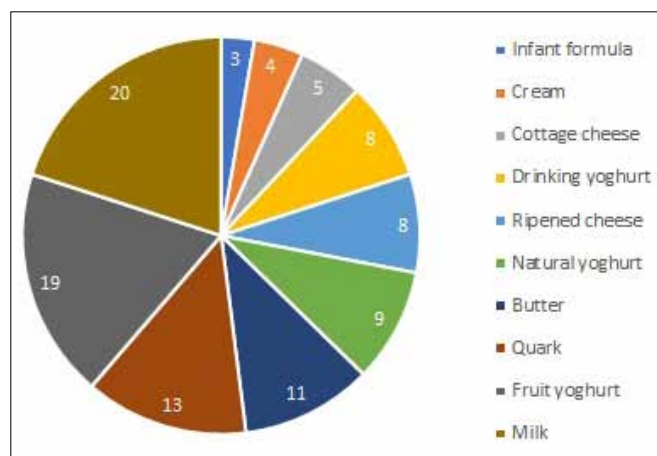
Źródło: Badania własne

The basic dairy product, i.e. milk, was easily available in all the analyzed stores. 15 types of drinking milk were found, produced by 8 different producers, which constituted 20% of the available range. Flavored yoghurt was another popular dairy product, which accounted for 19% of the lactose-free range. Then quark (13%), spreadable fats (11%), natural yoghurt (9%), ripened cheese and drinking yoghurt (8%). Cottage cheese (5%), cream (4%) as well as baby food (3%) were available in the smallest quantities.

Not many companies are involved in the production of dairy lactose-free products on the Polish market. In the study, products from 25 manufacturers from different countries were available.

The most available products (23%) were produced by the Polish Dairy Cooperative Mlekovita (Fig. 4). This company definitely outperforms other producers in its lactose-free range. The product range offered by Tesco (9%), which produces its lactose-free products under its own brand in Hungary, was much smaller. Only 9% of lactose-free products from the Polish company Mlekpól were available. OSM Łowicz (8%) and Magda Yoghurt (8%) are slightly less, and Bakoma the least (4%). The German company Breisgaumilch provided 7% lactose-free products, and Molkerei Gropper 4%.

Products available from one or two producers accounted for 28% and were German companies (AF Deutschland GmbH, Heirler, MinusLZott, Hochland), Swedish-Danish (Arla), Polish (Bielmar, Lumiko, OSM Grodzisk Mazowiecki, OSM Koło, OSM Maluta, Piątnica), Swiss (Nestle), Italian (Nuova Castelli, Sterilgardaalimenti), French (Nutricia), Dutch-British (Unilever).



**Fig. 4. Availability of the lactose-free product range by manufacturer (%).**

**Rys. 4. Dostępności asortymentu produktów bez laktozy z podziałem na producentów (%).**

Source: Own study

Źródło: Badania własne

In order to achieve the best market position, world producers introduce innovative products and change their production technology. Companies such as Arla Foods, McNeil Nutritionals, Omira, Parmalat and Valio are the leading players on the global market for this type of products [7].

The first Polish company that produced UHT lactose-free milk was the “Maćkowy” District Dairy Cooperative in Gdańsk, which was then taken over by Polmlek [7]. This took place over 30 years ago, and the authors of the technology used were employees of the Department of Food Biotechnology at the University of Warmia and Mazury in Olsztyn [3]. However, until 2010, only Spółdzielnia Mleczarska Gostyń, Polmlek, Okręgowa Spółdzielnia Mleczarska Garwolin and Candia Polska were involved in the production of lactose-free milk. And these products began to be produced on a larger scale only in 2015. At the moment, the range of lactose-free products has developed significantly. In addition to milk, cream or butter, these are also more processed products, i.e. ice cream or ripening cheese [16, 17].

Manufacturers wanted their products to be noticed by potential customers and meet their expectations. Therefore, on the label of each of the available articles it was easy to see the words “lactose-free”. However, with careful analysis of the label, we come across the information that the lactose content is  $<0.01\text{g per }100\text{g} / 100\text{ml}$  of product. This is due to the fact that the lactose has not been removed but has only been degraded by the lactase enzyme, so that small amounts may remain. Only 24% of dairy products did not have the information about the lactose content on the label, which may indicate the use of another technology.

Regulation 1169/2011 regulates the list of substances and products causing allergies or intolerances, which include lactose-containing milk [11]. In contrast, the use of the term ‘lactosefree’ in accordance with the scientific opinion of the Food Safety Authority [5] and the opinion of GIS [6] can be used in the context of the presence of a substance that can cause allergic or intolerance reactions only if the final product



does not contain lactose or if the consumer would expect the presence of lactose in a given product. The maximum allowable level of lactose in “non-lactose” products can be 0.01% (10 mg lactose per 100 g of product), which is at the limit of detection of lactose in the product [14].

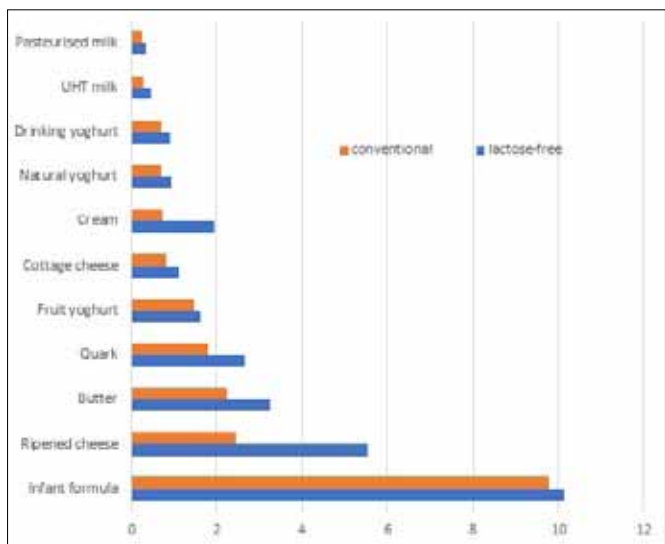
Customers who are looking for lactose-free products are particularly worried about their high price. Unfortunately, they are right. The prices of these food products outweigh those of their conventional counterparts. This is due to the increase in the costs of production at which enzyme or membrane methods should be used. The treatment that is most often used for this purpose is enzymatic hydrolysis of lactase, but also membrane filtration – ultrafiltration and diafiltration. These processes are expensive, which means a higher price of the product in the store [2].

For the production of lactose-free milk, enzymatic hydrolysis is applied using preparations of  $\beta$ -galactosidase, which are obtained in the process of microbial biosynthesis using selected strains of bacteria, filamentous fungi or yeast. Manufacturers most often use yeast strains – *Kluyveromyceslactis*, *Kluyveromycesfragilis* or fungi – *Aspergillus niger* [3]. There are two methods for introducing lactase into the product. The simplest method of producing milk with reduced lactose content is the addition of lactase to the milk batch before UHT treatment. However, the development of aseptic packaging allowed for sterile addition of the enzyme to each milk carton. This reduces the cost of production by using less lactase, and also saves storage time, which is necessary for hydrolysis to be carried out properly [13]. Alternative methods for obtaining lactose-free milk are membrane techniques [3]. In their work, Morlock et al. [10] described a process that consists of three stages based on membrane filtration, followed by reconnection. The stages of this process are: ultrafiltration – the so-called permeate, nanofiltration – filtrate, reverse osmosis. Thanks to this technology, you can separate half of the lactose contained in milk without any other changes in its composition. To eliminate it completely, you can use lactase additionally. Ultimately, milk has the same organoleptic characteristics as a conventional product and is in line with consumer expectations.

Figure 5 shows a comparison of average prices for 100g / 100ml lactose-free and conventional product.

Lactose-free products were more expensive than the conventional ones. The biggest difference in price was visible on the example of lactose-free cream, which was 166% more expensive than conventional cream and ripening cheese, more expensive by 126%. Among lactose-free ripening cheeses, there were cheeses from BIO crops, which further contributed to their much higher price. Pasteurized milk was more expensive by 32% and UHT milk by 62%. Lactose-free drinking yoghurts were more expensive by 30% on average and natural yoghurts by 33%. Lactose-free spreads cost 44% more than conventional spreads, and cottage cheese 48% more.

The smallest price difference was recorded for fruit yoghurt (10%) and lactose-free infant formula (4%).



**Fig. 5. Average price in PLN for 100g / 100ml lactose and conventional products.**

**Rys. 5. Średnia cena w PLN za 100g/100ml produktów bezlaktozowych i konwencjonalnych.**

**Source:** Own study

**Źródło:** Badania własne

The prices of the products largely depended on their producers. The chart below (Fig. 6) presents average prices of selected lactose-free dairy products depending on the manufacturer.

In the analyzed stores, the most expensive lactose-free products were offered by the German company Breisgaumilch (new name Schwarzwaldmilch). The UHT milk produced by this company was by about 150% more expensive than milk offered by Polish producers. Few lactose-free products produced by OSM Piątnica were found in the analyzed stores. However, the price of drinking lactose-free milk 2% Piątnica was almost 50% higher than milk of OSM Koło or Łowicz.

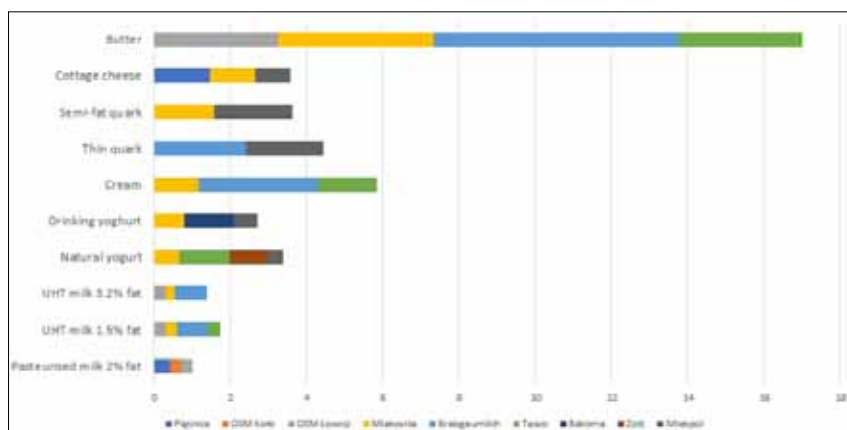
In Poland, currently the two largest producers of lactose-free foodstuff are the Mlekovita group and the Łowicz District Dairy Cooperative [12].

Among the available lactose-free products, SM Mlekovita offered the widest range. Some products, however, were slightly cheaper in the case of other Polish producers.

Despite the lack of differences in the composition and nutritional value of lactose-free and conventional products, these products differed organoleptically. Lactose-free milk is much sweeter, and in the study of Adhikari and colleagues [1] some respondents felt a chalky taste in it [3].

## OTHER LACTOSE-FREE PRODUCTS

Speaking of lactose, we immediately associate it with milk and its products. However, there are also other products that are not made from milk but still contain lactose. The addition of this sugar to the product increases the viscosity of food products, which is accompanied by a pleasant feeling while chewing. Lactose is used, among others, as an addition in the production of e.g. fries, bread or croquettes, because during baking it causes a brown color, which is a beneficial feature of these products. Sweets loved by all children, can also contain lactose, which is added to prevent the formation



**Fig. 6.** Average price in PLN for 100g / 100ml lactose-free product depending on the manufacturer.

**Rys. 6.** Średnie ceny w PLN za 100g/100ml produktów bezlaktozowych w zależności od producenta.

**Source:** Own study

**Źródło:** Badania własne

of sugar crystals in solutions. It is also used as a carrier of the active substance in the production of medicines, for aromatic ingredients, flavor enhancers and sweeteners. Products that we would not expect the presence of lactose at all are meat products, where it is used to improve the smell, taste and texture [8].

In order to meet the expectations of customers, the Polish market also offers alternative lactose-free products to lactose-free dairy products. In addition, they are often also gluten-free products that are safe for people suffering from celiac disease.

Of these products found on the Polish market, ice-cream (26.7%) was the largest part, followed by cookies (20%), chocolate and chocolate products (20%), followed by frozen pizzas (13.2%), but also available: iced coffee, banana chips or different types of bread (6.7% each).

The market for non-dairy lactose-free products is still growing. The Belgian company Damhert offers its customers a wide range of non-dairy lactose-free products, including ketchup, frozen fruit cakes, baguettes, hamburger rolls, dark and light bread, Kaiser rolls, breadsticks, macaroni, fishsticks, fruit muesli, honeyballs, biscuits, a large assortment of cookies, chocolate, preserves, a mixture of pancakes, powdered soups and sweetener tagatosis [4]. The lactose-free market has great potential. The main development factor is the continuous increase in the number of people intolerance to lactose [7]. However, it should mainly be directed to people with lactose intolerance, because for healthy people these products are unnecessary and even harmful to the body. By consuming lactose-free products, the lactase enzyme found in healthy people will cease to be active, because it will not have the possibility to work. If we all consume lactose-free products, we will reverse evolutionarily, because our enzyme system will cease to be active [16].

## CONCLUSIONS

1. Much greater availability of lactose-free products was offered by online stores, but the range of this product group in stationary stores is still increasing.

2. Among the analyzed groups of lactose-free dairy products such as pasteurized and UHT milk, natural, drinkable and flavored yoghurt, cream, quark cheese, cottage cheese, ripened cheese, spreadable fats and infant formula, the most easily available products were milk and flavored yoghurt. Cottage cheese, cream and infant formula were the least available.
3. The most lactose-free products available on the market were produced by the Mlekovita Dairy Cooperative.
4. Based on the analysis of the labels, no differences were found in the composition of lactose-free products compared to conventional ones. The differentiating feature was the higher price of lactose-free products compared to the conventional ones from 4 to even 166%. The most expensive lactose-free products were offered by the German company Breisgaumilch.
5. There are more and more alternative products to lactose-free dairy products available on the Polish market i.e. drinks or yoghurts based on vegetable raw materials, as well as products in which lactose-free milk was used as an additive i.e. ice-cream, cakes, chocolate.

## WNIOSKI

1. Dużo większa dostępność produktów bezlaktozowych oferowana była przez sklepy internetowe, niemniej jednak asortyment tej grupy produktów w sklepach stacjonarnych ciągle wzrasta.
2. Wśród analizowanych grup produktów mlecznych bezlaktozowych takich jak mleka pasteryzowane i UHT, jogurty naturalne, pitne oraz smakowe, śmietany, twarogi, serki wiejskie, sery żółte, tłuszcze do smarowania oraz odżywki dla niemowląt, najłatwiej dostępnymi produktami było mleko oraz jogurty smakowe. Najmniejszą dostępnością cechowały się serki wiejskie, śmietany oraz odżywki dla niemowląt.
3. Najwięcej dostępnych na rynku produktów bezlaktozowych wyprodukowanych zostało przez Spółdzielnię Mleczarską Mlekovita.
4. Na podstawie analizy etykiet nie wykazano różnic w składzie produktów bezlaktozowych w porównaniu do konwencjonalnych. Cechą różnicującą była wyższa cena produktów bezlaktozowych w stosunku do konwencjonalnych od 4 do nawet 166%. Najdroższe produkty bezlaktozowe oferowała niemiecka firma Breisgaumilch.
5. Na polskim rynku dostępnych jest coraz więcej produktów alternatywnych dla mlecznych produktów bezlaktozowych, tj. napoje czy jogurty na bazie surowców roślinnych, jak również produkty, w których zastosowano jako dodatek mleko bez laktozy, tj. lody, ciasta, czekolady.

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