

DYNAMICS OF PRODUCTION, CONSUMPTION AND EXPERTISE OF BUTTER ON THE CONSUMER MARKET OF THE REPUBLIC OF MOLDOVA

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Abstract: The excellent taste, pleasant aroma, high content of fat-soluble vitamins and high digestibility of nutrients make butter an indispensable product in the diet. In the top countries, regarding the production of butter, it stands out: India, in second place are the countries of the European Union and in third place is the USA. The statistical data on butter consumption per capita show that the world leader in this ranking is France (recording 8.0 kg per capita for the year 2021), compared to the Republic of Moldova for the same year (2.3 kg per capita by resident). Nutritionists recommend consuming about 5.5 kg of butter per year and about 15 g per day.

The purpose of the work was: studying the situation regarding the production, marketing, consumption and quality of the cow's butter presented on the consumer market of the Republic of Moldova.

As research materials were used: National Statistical data, legislative and normative documents in force regarding milk and dairy products, the Report on the Study of the Development Potential of Dairy Products from the Republic of Moldova, as well as samples of butter from different producers.

The methods applied in this research were: analysis and statistics, comparison and expertise.

As an object of study in butter expertise, 9 types of butter were used, of which: 4 types are domestically produced, and the other 5 - are imported (originating from: Italy, Denmark, Belarus, Ukraine and Austria).

All the results obtained demonstrate that the butter sold on the Chisinau market is of dubious quality and all the checked products have at least one non-compliance.

Keywords: butter, quality, expertise, sensory analysis, information on the label

Introduction

Butter and its nutritional importance were already known about 5000 years ago, but this fact was officially demonstrated only in the 19th century. The history of butter tells us that this product often fought for its fame and good reputation, all because of the appearance of margarine, which was mistakenly considered healthier than butter.

Nowadays, a lot of states severely restrict the production of *trans fats*. Thus, from 2018 they can represent only 2% of the total fat in a product. And in some countries, for example the USA, trans fats are prohibited in quantities more than 0,5g per portion of the product.

The excellent taste, aroma, high content of fat-soluble vitamins, high digestibility of nutrients (on average 97% for fats and 94% for dry substances in plasma), make butter an indispensable product in the diet.

Thanks to the fact that in the active life of society around the world, in less than a century, a diversity of ethnicities and cultures have been combined, with its customs, traditions, tastes and needs regarding color, consistency, smell for any product, including butter, they involuntarily influenced the creation of the assortment concept.

On the national level, the main butter producers in the Republic of Moldova are: JLC from Chisinau, Butter Factory from Florești S.A. "MILKMARK, Fabrica Oloi Pak from Comrat, Met Sa Produze Impex from Drochia, etc., and on an international level, the most recognized global butter brand is considered to be "Lurpak", owned by the Scandinavian company Arla Foods. Lurpak brand butter is sold in over 75 countries, including the Republic of Moldova. This butter has been produced since 1901 exclusively from Danish milk.

In the top countries, regarding the production of butter, it stands out: India (which produced 6.5 million tons of butter in 2022), in second place are the countries of the European Union (with a production of 2.08 million tons), highlighting in particular Germany, the country that produces the most butter in the European Union, owning 23% of butter production, and in third place is the USA (producing 0.93 million tons of butter in 2022) [9].

The statistical data on butter consumption per capita show that the world leader in this ranking is France (8.0 kg per capita for the year 2021), compared to the Republic of Moldova for the same year (2.3 kg per capita inhabitant). Nutritionists recommend consuming about 5.5 kg of butter per year and about 15 g per day.

The Republic of Moldova imports almost three times more butter than it exports. Thus, imports in 2021 reached 1697 thousand tons, while exports were only 539 thousand tons.

The world situation of butter exports by year, from the countries of the European Union, shows that mostly this product is exported to the USA from such countries as: Ireland (29,879 thousand tons) and the Netherlands (8,515 thousand tons).

Globally, butter is the most frequently falsified dairy product, by partially or totally substituting it with: margarine, beef or sheep tallow, porc lard, starchy products, etc.

The purpose of the work was: studying the situation regarding the production, marketing, consumption and quality of the cow's butter presented on the consumer market of the Republic of Moldova.

Materials and methods

As research materials were used the following sources: information from the National Bureau of Statistics, specialized literature, including legislative and normative documents in force regarding milk and dairy products, the Report on the Study of the Development Potential of Dairy Products from the Republic of Moldova, as well as samples of butter from different producers.

The methods applied in this research were: analysis and statistics, comparison and expertise.

Results and discussions

Currently, the dairy industry is one of the important branches of the agro-food sector in the Republic of Moldova, a branch that must provide the population with safe, harmless and high-quality dairy products.

Analyzing the situation of the dairy sector, we found out that in recent decades, the milk processing industry in the Republic of Moldova has registered a continuous decline. A study by the Investment Agency and the National Association of Milk and Dairy Products Producers shows that, in the last ten years, production has decreased by 38%, and imports have increased 4 times [6].

Currently, according to the experts [4], the milk production industry in the Republic of Moldova is in a deep crisis. The share of agricultural enterprises in total milk produced is only 6%. Processors in turn are forced to collect milk from individual households, with low quality and productivity and excessive costs in collection logistics. All this results from a shortage of domestic milk as a raw material and as a result of the year-on-year increase in milk imports.

A particularly important product that is part of the category of dairy products is butter.

Currently, the domestic production of butter covers domestic consumption needs only at the level of 53-60% and in recent years there has been a tendency to decrease the level of self-supply, and in this case imports are resorted to.

The amount of butter produced in the Republic of Moldova for the period 2011-2021 is presented in figure 1.

The data of this diagram show that the largest volume of butter in the Republic of Moldova was produced in 2016 (5868.7 thousand tons). Then a significant decrease is observed - up to 3668 thousand tons (-37.5%) in 2021 [7].

The total production of butter in the world is more than 10 million tons, increasing every year [8]. Thus, in 2016, butter production increased by 4.2%, which constituted 9.6 million tons. In 2017, production increased by 2.7% (9.9 million tons). In 2018, global butter production increased by 1.3%.

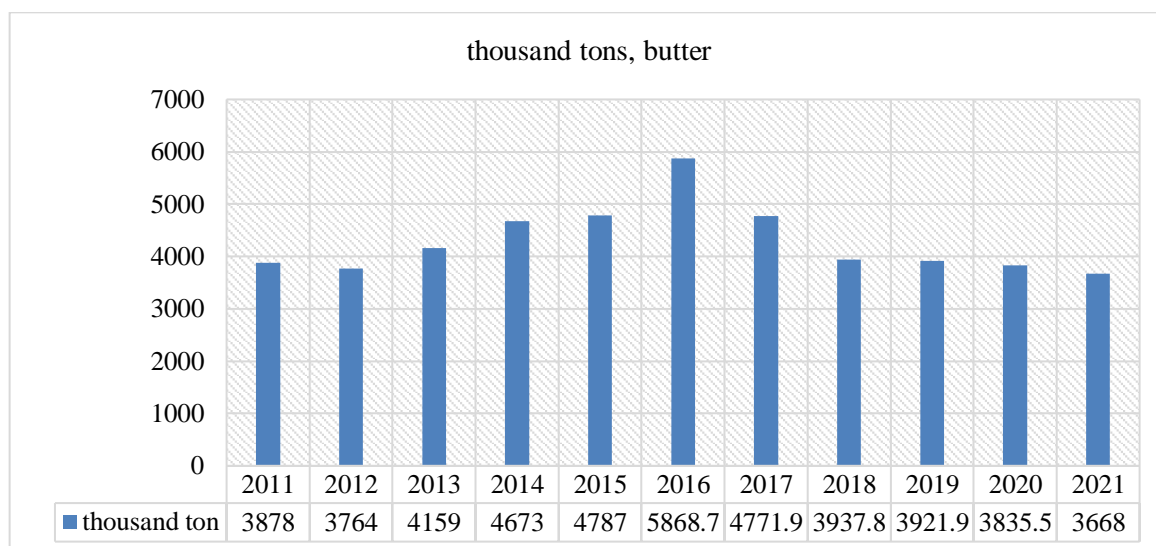


Figure 1. Butter production on a national level

Source: National Bureau of Statistics."Production of the main industrial products by types and years".Kishineu. Available:https://statistica.gov.md/files/files/publicatii_electronice/Anuar_Statistic/2022/Anuarul_statistic_edita_2022.pdf

In 2022, more than half of the world's butter was produced by India (6.5 million tons). In second place are the countries of the European Union with a production of 2.08 million tons, butter. The rest of the countries produced less than 1 million tons of butter. The USA is in third place with an index of 0.93 million tons [8], (figure 2).

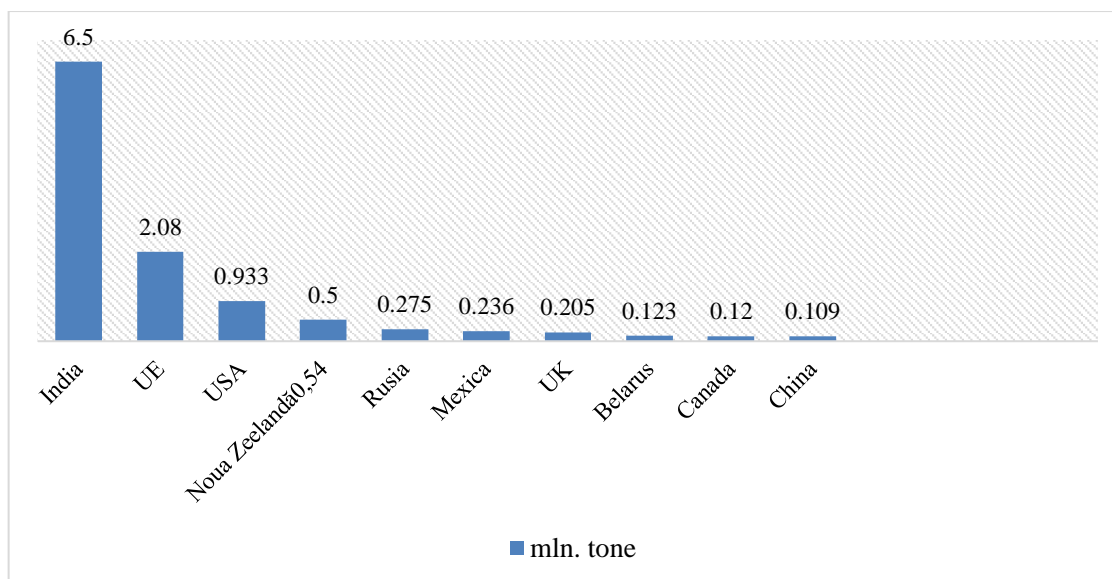


Figure 2. Butter production in the world's states and leading countries in 2022, million tons

Source: <https://www.statista.com/statistics/195805/butter-production-in-selected-countries/>

Among the dominant countries in the production of butter within the European Union, in 2021 and 2022, stood out: Germany, France, Ireland, Poland, Holland, Belgium, Italy, Denmark and others.

The information on the top of the European Union countries according to the significant amount of cow butter production is structured in table 1.

Table 1. Top of the European Union countries regarding butter production for the years 2016-2021, million tons

Butter production (tons)							
Countries UE	2016	2017	2018	2019	2020	2021	2022
Germany	516.100	496.780	484.041	497.104	505.436	471.059	472,574
France	435.400	411.980	420.280	414.230	413.100	407.310	404,140
Ireland	198.700	223.670	237.840	251.070	264.720	275.080	269,190
Poland	203.930	213.020	221.760	224.610	243.300	231.410	243,070
Netherlands	161.300	148.900	153.800	136.400	133.500	137.700	138,300
Belgium	57.550	64.600	64.240	111.960	122.590	109.650	107,510
Italy	95.400	91.220	95.580	96.200	94.010	98.470	100,510
Denmark	56.300	57.000	74.000	74.700	72.700	81.500	85,100

Source: https://www.clal.it/en/index.php?section=produzioni_burro

The situation regarding the export and import of dairy products in the Republic of Moldova is as follows: the volume of exports of dairy products registered a stable increase of about 2.4 times during the period 2013-2017. During the same period, dairy imports increased 2.1 times.

The largest increases in import volumes were recorded for products in group 0405 "Butter, including dehydrated butter and other milk-derived fats".

The balance of foreign trade in butter is shown in table 2.

Table 2. Butter export and import of the Republic of Moldova from 2013-2021 (thousand tons)

Products from group 0405 "Butter, including dehydrated butter and other milk fats"									
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Export	475	401	747	1597	542	500	0	612	539
Import	709	414	420	661	1626	2091	1867	1931	1697
Balance	-234	-17	327	936	-1084	-1591	-1867	-1.319	-1.158

Source: The national program for the development of the milk sector in the Republic of Moldova 2020-2025 [10], www.ibit.ly/kh4I

Currently, Ukraine, Romania and Belarus are the leading butter exporting countries to the Republic of Moldova [5].

At the same time, specialists of dairy products mention that the non-utilization of processing capacities and the outdated equipment of milk collection and processing enterprises, generate large production losses. The increased cost price of domestic dairy products (due to shelf taxes imposed by traders), favors their import, which also influences the competitiveness compartment. Outdated equipment and technologies increase energy consumption and in order to reduce expenses, it is necessary to retool milk processing enterprises. Some companies, since 2009, have initiated the procedure of reusing and implementing the HACCP and ISO 22000 system.

At the level of world consumption, it is recommended to consume butter in a volume of 5,5 kg per year per capita.

After analyzing the statistical information, we can mention that the dynamics of butter consumption per capita is different for different countries and is not dependent on the production capacity of this product. The dynamics of butter consumption per capita in the Republic of Moldova and other countries in the European Union and outside it are presented below (table 3).

Table 3. Dynamics of butter consumption per capita structured by years and countries

Countries	Butter consumption (kg per capita)/ per year				
	2017	2018	2019	2020	2021
France	7,5	7,8	8,1	8,2	8,0
Denmark	5,7	5,9	6,1	6,4	6,7
Switzerland	4,6	4,9	4,8	5,2	5,5
India	2,8	3,2	3,1	3,6	3,9
US	2,2	2,5	2,8	3,0	3,3
Republic of Moldova	1,2	1,1	2,5	2,4	2,3
Ukraine	1,5	1,4	1,7	1,9	1,6
Australia	0,2	0,1	0,3	0,3	0,5


Source: National Bureau of Statistics, "Consumption of food products (per inhabitant per year; kilograms)". Available: www.ibit.ly/oa1I



The information in table 3 shows that the world leader in butter consumption per capita is France. The dynamics of butter consumption in France for five years (from 7.5 kg/capita in 2017 to 8.0 kg/capita in 2021) is constantly increasing. In second place is Denmark, a country that both produces significant amounts of butter (only in 2021 it produced 81,500 thousand tons), but which also consumes this product to the same extent (6.7 kg/ per capita). Regarding India, we can note that it is the world leader in terms of butter production (6.5 million tons in 2022), but not in butter consumption, placing itself in the middle of the ranking in table 3 (with 3.9 kg/ per capita).

The volume of butter consumption per capita in the Republic of Moldova has exceeded the one of Ukraine (2.3 kg per capita), the country from which the Republic of Moldova imports the largest amount of butter per year.

As the object of study of butter expertise, in this paper, 9 types of butter were used (table 4), of which: 4 types are domestic products, and the other 5 - are imported (originating from: Italy, Denmark, Belarus, Ukraine, Austria).

Table 4. Types of butter investigated for the purpose of expertise

nr	Product name	Fatcontent, %	Net weight, g	Price, lei pe 1kg*	Images
Domestic butter					
1	sterilized sweet cream butter, "Unt de casă", Met. Impex products, Drochia	82,0	200e	188,5	
2	salted sweet cream butter, „Unt de casă”, Ferma cu origini, Kishineu, Kodru	82,5	200e	179	
3	salted sweet cream butter, „Unt de casă”, Biomilk, Orhei	82,5	- (notindicated)	167,5	
4	salted sweet cream butter „Țărănesc” Nr.1, Lactis. Râșcani	72,5	200e	168	
Imported butter					
5	salted sweet cream butter, „Țărănesc” OMO”, VL-Group Service, Ukraine	73,0	200e	139	
6	salted sweet cream butter, „Zanetti”, S.p.A.- Via Madonna, Italia	82,0	125	125	
7	salted sweet cream butter „LURPAK”, Delaco Distribution, Denmark	82,0	200e	308	

8	salted sweet cream butter „Sterzing-Vipiteno”, Cooperative Latteria-Vipiteno, Austria	82,0	125e	161,25	
9	salted sweet cream butter „Рогачевъ”, Belarus	82,5	180e	177	

Source: Prepared by the authors

* the exchange rate on the day of the research: 1EUR = 19,73MDL; 1USD = 17,96 MDL

In our research, the following types of butter expertise were carried out:

- ♦ *the information expertise* of the butter (it was carried out by checking the information stipulated on the product labels with the requirements of Law no. 279 of the Republic of Moldova on informing consumers about food products;
- ♦ *the quantitative expertise* of the butter (checking the net mass of the products by weighing them);
- ♦ *the qualitative expertise* of butter (organoleptic determinations and sensory analysis of butter, naturalness and degree of freshness).

In order to carry out these expertises, both standardized methods (verification of the net mass, organoleptic verification, etc.) and non-standardized methods were used: (the organoleptic method with the scoring scale, qualitative-express methods for detecting the presence of margarine and the presence of animal fats of non-dairy origin, as well as the microscopic method for determining the freshness of butter).

Research results

The information expertise of the butter was carried out by verifying the information presented on the product label with the requirements of Law no. 279 of the Republic of Moldova *Regarding informing consumers about food products*. [1].

According to this law, for butter, it is mandatory to mention the following information:

- ♦ the name of the food product;
- ♦ list of ingredients;
- ♦ the net weight of food product;
- ♦ information on the validity of the food product;
- ♦ special storage conditions;
- ♦ the name or trade name and address of the food operator;
- ♦ country / place of origin;
- ♦ a nutritional declaration;
- ♦ a note on lot identification.

At the same time, we mention that Law 279 also specifies some linguistic requirements, for example: mandatory information about food products must be written in Romanian directly on the packaging or on the food product label.

Checking the information on the labels shows that 8 products, out of the 9 examined, contain all the mandatory statements. Several non-conformities (lack of information regarding the address of the producer, net weight) were registered for the products: Sweet cream butter, unsalted, " Unt de casă ", Biomilk, Orhei.

Carrying out the informational expertise and by checking the state of the packaging, we noticed a negative moment, namely - the name of the product is covered with redundant information, for example, "Discount" (butter from sweet, unsalted cream, "Sterzing-Vipiteno", Cooperative Latteria-Vipiteno, Austria, product no. 8 from table 4). We believe that this phenomenon represents an inconvenience for consumers.

The quantitative expertise of butter in our research involves checking the net weight of the products. For this purpose we checked whether the actual net weight corresponds to that declared on the butter labels. The results of the quantitative expertise are presented in table 5.

Tabelul 5. Rezultatele expertizei cantitative a untului

Product name	Net weight, g		Note of conformity
	Indicated on the label	actual	
1.Pasteurized sweet cream butter, "Unt de casă ", Met. Impex products, Drochia	200e	200	conform
2.Unsalted sweet cream butter,„Unt de casă”, Ferma cu origini, Kishineu, Kodru	200e	200	conform
3.Unsalted sweet cream butter,„Unt de casă”, Biomilk, Orhei	-(is not indicated)	193,61	Lack the information
4.Unsalted sweet cream butter „Țărănesc” Nr.1, Lactis. Râșcani	200e	196,68	nonconform
5.Unsalted sweet cream butter,„Țărănesc” „KOMO”, VL-Group Service, Ukraine	200e	197,54	nonconform
6.Unsalted sweet cream butter,„Zanetti”, S.p.A.-Via Madonna, Italia	125	121,17	nonconform
7.Unsalted sweet cream butter „LURPAK”, Delaco Distribution, Denmark	200e	200	conform
8.Unsalted sweet cream butter „Sterzing-Vipiteno”, Cooperative Latteria-Vipiteno, Austria	125e	125	conform
9.Unsalted sweet cream butter „Рогочевъ”, Belarus	180E	180	conform

Source: Prepared by the authors

Based on the information presented in table 5 regarding the verification of the net mass of the analyzed samples, we found non-conformities in three butter samples: (unsalted sweet cream butter "Unt de casă", Orhei Biomilk; unsalted sweet cream butter "Țărănesc" No. 1, Lactis, Râșcani; unsalted sweet cream butter,„Țărănesc” „KOMO”, VL-Group Service, Ukraine; unsalted sweet cream butter „Zanetti", S.p.A.-Via Madonna, Italy).

The qualitative expertise was carried out through sensory analysis, identifying the presence of foreign fats (margarine, beef tallow) and determining the degree of freshness of the butter.

The organoleptic analysis was carried out by the standardized and non-standardized method (20-point scale). The standardized method is based on the requirements set out in the normative documents in force, namely - *Decision of the Government of the Republic of Moldova (HG) 158 regarding the approval of the Quality Requirements for milk and dairy products* [2, annex 6]. The following characteristics have to be appreciated: the appearance (on the surface and in the section), the consistency at (12±2)°C, the smell and the taste of butter.

The non-standardized method represents the appreciation of the butter quality category according to the number of points awarded to the products by experts.

The sensory analysis of the butter, including packaging and marking, is carried out according to the 20-point system, which is distributed as follows:

- taste and smell – 10 points;
- consistency and external appearance – 5 points;
- color – 2 points;
- packaging and marking – 3 points.

Depending on the accumulated score, the butter can be of the higher category (17-20 points) or first (11-16 points).

Butter with an overall rating of less than 11 points is not accepted for sale.

The results of the organoleptic examination of the butter are presented in table 6.

Table 6. Results of the organoleptic examination of butter carried out by the standardized method (according to HG158) and non-standardized (sensory analysis)

The name of the product	Correspondence with the Technical Regulations (HG 158, annex 6)	Sensory analysis, points	Quality category	
			Indicated on the label	Actual
1.Pasteurized sweet cream butter, "Unt de casă", Met. Impex products, Drochia	Conform	18		
2.Unsalted sweet cream butter, „Unt de casă”, Ferma cu origini, Kishineu, Kodru	Conform	18		
3.Unsalted sweet cream butter, „Unt de casă”, Biomilk, Orhei	With some inessential deviations from the norm	16		
4.Unsalted sweet cream butter „Țărănesc” Nr.1, Lactis. Râșcani	With some inessential deviations from the norm	17	Superiory category	
5.Unsalted sweet cream butter, „Țărănesc” „KOMO”, VL-Group Service, Ukraine	Conform	18		
6.Unsalted sweet cream butter, „Zanetti”, S.p.A.- Via Madonna, Italia	With some inessential deviations from the norm	16		
7.Unsalted sweet cream butter „LURPAK”, Delaco Distribution, Denmark	Conform	18		
8.Unsalted sweet cream butter „Sterzing-Vipiteno”, Cooperative Latteria-Vipiteno, Austria	With some inessential deviations from the norm	18	Superiory category	
9.Unsalted sweet cream butter „Рогочевъ”, Belarus	Conform	18	Superiory category	

Note: the quality class was rated: „-”- it is not indicated on the packaging; „S”- superior category; „I”- first category

Source: Prepared by the authors

The organoleptic examination of the butter carried out by the standardized method (according to the requirements of HG158) showed the following results:

1. *pasteurized sweet cream butter, "Unt de casă", Met. Impex products, Drochia:* (in the section the color of the butter is white, the consistency is ointment, without foreign tastes and smells, externally the butter is yellowish-white in color);
2. *unsalted sweet cream butter, „Unt de casă”, Ferma cu origini, Kishineu, Kodru:* (in the section the butter is less uniform, the color is pronounced yellow, without foreign tastes and odors, with an ointment consistency);
3. *unsalted sweet cream butter, „Unt de casă”, Biomilk, Orhei:* (the color of the butter is yellowish, the taste is unpronounced, the aftertaste has rancid nuances, the consistency is ointment);
4. *unsalted sweet cream butter „Țărănesc” Nr.1, Lactis. Râșcani:* (the color of the butter is yellowish-white, it does not have water drops, it has a faint aftertaste of rancid fat);
5. *unsalted sweet cream butter, „Țărănesc”, KOMO”, VL-Group Service, Ukraine* (the taste of whipped cream is less pronounced, in the section the butter is uniform, the color is yellow);
6. *unsalted sweet cream butter, „Zanetti”, S.p.A.-Via Madonna, Italia:* (it tastes like rancid fat, the consistency is homogeneous);
7. *unsalted sweet cream butter „LURPAK”, Delaco Distribution, Denmark:* (it has a yellow color, homogeneous consistency, without visible water drops);
8. *unsalted sweet cream butter „Sterzing-Vipiteno”, Cooperative Latteria-Vipiteno, Austria:* (in the section the butter is homogeneous, uniform, the color is yellowish, the taste and smell are good);
9. *unsalted sweet cream butter „Погоцель”, Belarus:* (it has a taste and smell close to the perfect one, the consistency is homogeneous, the color is yellowish).

The results of the sensory analysis, carried out by the scoring method, showed that all the butter samples subjected to research correspond to the prescribed requirements for each quality category, but none of the samples received the maximum score.

According to the accumulated score, 2 butter samples (Sweet cream butter, unsalted, "Zanetti", S.p.A.-Via Madonna, Italy and Sweet cream butter, unsalted, " Unt de casă", Biomilk, Orhei) correspond to the first category, and the other 7 samples – correspond to the superior category (table 6).

At the same time, we mention that the obtained results confirm the superior quality category of the butter that is indicated on its packaging, in the case of samples 4,8,9 from table 6.

Butter is one of the top falsified food products. Therefore, the next stage of butter expertise was - determining its naturalness by identifying the presence of foreign (non-dairy) fats. The most frequently detected falsifications consist in the substitution of butter with margarine or fats of animal origin, but not dairy fats.

The results of these determinations are presented in table 7.

The results of this analysis show that all 9 butter samples contain margarine or other vegetable fats in varying proportions.

This was proven by the appearance of a bright red or red color in the lower layer of hydrochloric acid, taken in the analysis, which indicates the presence of margarine (or other fat of vegetable origin) [3].

Table 7. Results of the butter naturalness examination

The name of the product	The presence of margarine	The presence of beef tallow
1.Pasteurized sweet cream butter, "Unt de casă ", Met. Impex products, Drochia	+	Abundant precipitation
2.Unsalted sweet cream butter, „Unt de casă”, Ferma cu origini, Kishineu, Kodru	++	Abundant precipitation
3.Unsalted sweet cream butter, „Unt de casă”, Biomilk, Orhei	+	Abundant precipitation

4.Unsalted sweet cream butter „Țărănesc” Nr.1, Lactis. Râșcani	++	Abundant precipitation
5.Unsalted sweet cream butter„Țărănesc” „KOMO”, VL-Group Service, Ukraine	+	Abundant precipitation
6.Unsalted sweet cream butter„Zanetti”, S.p.A.-Via Madonna, Italia	++	Abundant precipitation
7.Unsalted sweet cream butter „LURPAK”, Delaco Distribution, Denmark	++	Insignificant precipitation
8.Unsalted sweet cream butter „Sterzing-Vipiteno”, Cooperative Latteria-Vipiteno, Austria	+++	Abundant precipitation
9.Unsalted sweet cream butter „Рогочевъ”, Belarus	+	Abundant precipitation

Note: Depending on the quantity of margarine added, the following types of coloring may occur: „-” – colorless; „+” – pale pink; „++” – pink; „+++” - pink-orange [3].

Source: Prepared by the authors

In figure 3 we have illustrated the result obtained from 2 samples, but which reflects the same result for each butter examined separately, since we did not obtain any natural butter from the 9 samples.

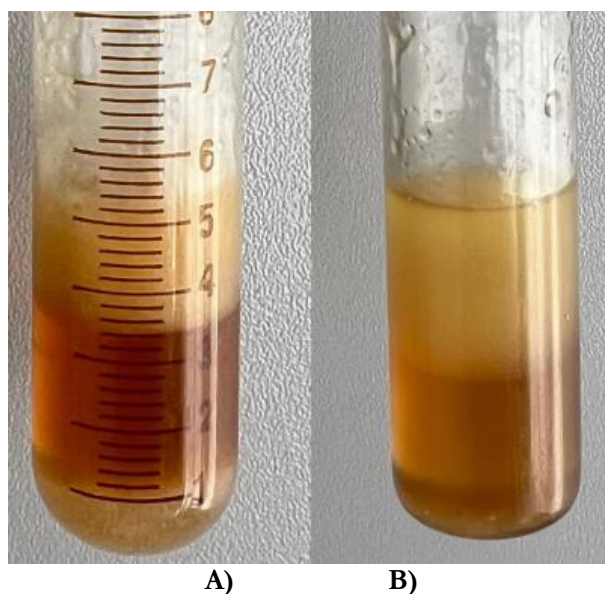


Fig. 3. The images of the results obtained when detecting the adulteration of butter with margarine

Note: A) adulterated butter with an increased amount of margarine; B) adulterated butter with a reduced amount of margarine.

Source: Prepared by the authors

Detection of butter adulteration by precipitation of beef tallow showed that all nine butter samples did not turn out to be natural, as they should be, based on the information declared on the label. By dissolving the fat in ether to which ethyl alcohol is added and after the specific processing of the mixture, the fat from the cow or buffalo butter remains clear, but if at least 5 g of beef tallow or 12% hydrogenated oil is added, a precipitate is obtained [3]. According to the information in table 7, all the butter samples are characterized by the presence of an abundant precipitate, which indicates the falsification of the products.



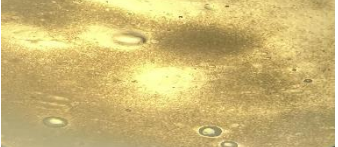

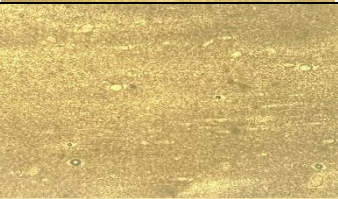
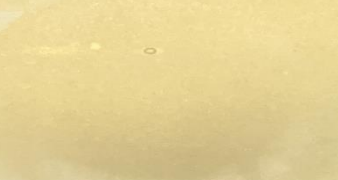
Because these determinations are qualitative and not quantitative, we cannot comment on the amount of butter substituted with other fats. A smaller amount of added margarine was detected in 2 local samples (Sweet cream butter, Unt de casă”, Met Produse Impex, Drochia; Sweet cream butter, Unt de casă”, Biomilk, Orhei) and to 2 imported products (“Țărănesc” butter from sweet cream, "KOMO", VL-Group Service S.R.L., Ukraine; Unsalted sweet cream butter „Рогочевь”, Belarus). The other varieties recorded a higher amount of margarine or beef tallow.




To check the freshness of the butter, an express microscopic method is used [3]. The results of these researches are presented in table 8.

Selling stale butter as fresh is also a violation. This falsification can be easily detected by microscopy of the butter which, depending on its freshness, can look like the images in table 8.

The presence of large water globules indicates that the studied butter is fresh, and their absence signals that the sample is of a susceptible freshness [3].

Table 8. Results of checking the freshness of butter

The name of the product	Microscopic analysis	Microscopic image of butter magnified 180 times
1.Pasteurized sweet cream butter, "Unt de casă ", Met. Impex products, Drochia	Large and small globules, dense, with the predominance of small ones (Microscopic image of fresh butter), (40 x 18)	
2.Unsalted sweet cream butter, „Unt de casă”, Ferma cu origini, Kishineu, Kodru	Without globules, fat is like a compact mass (Microscopic image of oxidized butter), (40 x 18)	
3.Unsalted sweet cream butter, „Unt de casă”, Biomilk, Orhei	Large globules, rare but well defined, and small globules, more numerous but poorly defined (Microscopic image of fresh butter), (40 x 18)	
4.Unsalted sweet cream butter „Țărănesc” Nr.1, Lactis. Râșcani	Large and small dense globules, but with the predominance of small ones (Microscopic image of fresh butter), (40 x 18)	
5.Unsalted sweet cream butter, „Țărănesc” „KOMO”, VL-Group Service, Ukraine	Medium globules, rare, otherwise the mass is flat, compact (Microscopic image of low freshness butter), (40 x 18)	
6.Unsalted sweet cream butter, „Zanetti”, S.p.A.-Via Madonna, Italia	The presence of a medium globule, otherwise the mass is flat, compact (Microscopic image of butter with a low degree of freshness), (40 x 18)	

<p>7. Unsalted sweet cream butter „LURPAK”, Delaco Distribution, Denmark</p>	<p>Large, rare, well-defined globules, otherwise the mass is flat, compact (Microscopic image of low freshness butter), (40 x 18)</p>	
<p>8. Unsalted sweet cream butter „Sterzing-Vipiteno”, Cooperative Latteria-Vipiteno, Austria</p>	<p>Medium, rare, well-defined globules, otherwise the mass is flat, compact (Microscopic image of low freshness butter), (40 x 18)</p>	
<p>9. Unsalted sweet cream butter „Рогочевь”, Belarus</p>	<p>Large, rare, well-defined globules, otherwise the mass is flat, compact (Microscopic image of fresh butter), (40 x 18)</p>	

Source: Prepared by the authors

In fresh butter, the fat molecules are present in the form of globules of different sizes dispersed in the aqueous phase of the butter, and in advanced oxidized butter, this dispersion is no longer visible, the fat is like a compact, dense mass of small globules, rarer, less highlighted.

Analyzing the data, presented in table 8, we notice that 2 samples (no. 2 and 6) out of the 9, obtained a negative result. These are: Unsalted sweet cream butter, Homemade butter, Farm with origins, Kishinev, Kodru; Unsalted sweet cream butter, „Zanetti”, S.p.A.-Via Madonna, Italy

All the results obtained demonstrate that the butter sold on the Chisinau market is of dubious quality and all the checked products have at least one non-compliance.

Conclusions

- In the top countries, regarding the production of butter, it stands out: India (which produced 6.5 million tons of butter in 2022), in second place are the countries of the European Union (with a production of 2.08 million tons), highlighting especially Germany, the country that produces the most butter in the European Union, holding 23% of butter production, and in third place is the USA (producing 0.93 million tons of butter in 2022).
- The largest volume of butter in the Republic of Moldova was produced in 2016 (5868.7 thousand tons). Then a significant decrease is observed - up to 3668 thousand tons (-37.5%) in 2021.
- The Republic of Moldova imports almost three times more butter than it exports. Thus, imports in 2021 reached 1697 thousand tons, while exports were only 539 thousand tons.
- Currently, Ukraine, Romania and Belarus are the leading butter exporting countries to the Republic of Moldova.
- The statistical data on the consumption of butter per capita, demonstrate that the world leader in this ranking is France (recording 8.0 kg per capita for the year 2021), compared to the Republic of Moldova for the same year, 2021, (2.3 kg per inhabitant). Nutritionists recommend that butter be consumed per inhabitant in a volume of 5.5 kg per year, and approximately 15g per day.
- As the object of study of the butter expertise, 9 varieties of butter were chosen, of which: 4 - are domestically produced, and the other 5 - are imported (originating from: Italy, Denmark, Belarus, Ukraine, Austria).
- Checking the information on the labels proves that 8 products out of the 9 analyzed contain all the mandatory information (according to Law no. 279). Several non-conformities (lack of information regarding the address of the producer, net weight) were registered for the product " Unt de casă", Biomilk, Orhei.

- For four samples of butter: ("Unt de casă", Biomilk, Orhei; "Tărănesc" No. 1, Lactis, Râșcani; „Tărănesc”, „KOMO”, VL-Group Service, Ukraine; „Zanetti", S.p.A.-Via Madonna, Italy) there were non-conformities regarding the net mass.
- The results of the assessment of the naturalness of the butter show that all 9 butter samples contain margarine and other non-dairy fats in different proportions.
- Determining the degree of freshness of the butter, we find that out of 9 analyzed samples, only two products showed a negative result, the butter being oxidized ("Unt de casa", Ferma cu origini S.R.L., Chisinau, Codru; „Zanetti", S.p.A.-Via Madonna, Italy).
- All the results of the expertise demonstrate that the butter sold on the consumer market of Chisinau is of dubious quality and all the checked products have at least one non-compliance.

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