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EVALUATION OF THE LEVEL OF SELF-SUFFICIENCY OF COW'S MILK PRODUCTION IN THE COUNTRIES OF CENTRAL AND EASTERN EUROPE[2]

Key words: cow's milk market, production, consumption, international trade, Central and Eastern European

ABSTRACT. Food self-sufficiency is considered one of the basic priorities for the functioning of modern food economies. The main aim of the study is to assess the level of self-sufficiency of cow's milk production in selected countries of Central and Eastern Europe. Thirteen Central and Eastern European countries were accepted as the research area. The study used simplified indicators of food self-sufficiency. Technical self-sufficiency included the volume approach to the foreign trade balance and the conversion of indices constituting the relation of the production volume per number of inhabitants and the volume of cow's milk consumption in relation to the production volume. Economic self-sufficiency was based on the study of the balance of foreign trade in terms of value. The study was conducted for the years 2015-2020. The research results indicate that the countries of Central and Eastern Europe are characterized by a significant degree of differentiation in terms of the self-sufficiency of cow's milk production. Most of the countries considered follow a safe food policy for this agricultural raw material. The lowest degree of self-sufficiency of cow's milk production is found in Bulgaria, Croatia and Romania. Moreover, it was found that the abolition of milk quotas in 2015 in the European Union countries did not result in a significant increase in the volume of cow's milk production.

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INTRODUCTION

Food self-sufficiency is one of the most important priorities for the functioning of modern economies. Research issues are of great interest, both in domestic and foreign literature. The problem of food self-sufficiency was investigated by Polish researchers, including: Agnieszka Baer-Nawrocka [2002, 2014], Iwona Szczepaniak [2012], Franciszek Kapusta [2012], Aneta Mikuła [2012], Pavel Kotyza and Josef Slaboch [2014], Krzysztof Firlej and Sebastian Kubala [2021], Sebastian Kubala and Marcin Stanuch [2021]. A rich resource of research can also be found in the case of foreign researchers: Anita Tiraspolsky [1980], Zdenka Gebeltova [2012], Steffen Noleppa and Matti Cartsburg [2013], Jean-Christophe Bureau and Johan Swinnen [2018], Stephen Wegren and Christel Elvestad [2018], Tatjana Brankov et al. [2021].

The very concept of food self-sufficiency is difficult to define due to the numerous changes in its concept that are closely related to economic changes. Agnieszka Obiedzińska [2012] indicates that the first definition related to self-sufficiency included only the supply side, which with the passage of time [Mikuła 2012] also expanded its meaning to include the demand side. Contemporary definitions focus on aspects related to ongoing globalization. The result was the evolution of the definition from self-sufficiency referring only to closed economies to a term illustrating the essence of open economies. In relation to closed economies, food self-sufficiency is the ability of an economy to produce all or most of the food it needs, which is measured by the relation of the volume of domestic production to the level of its consumption in the country [Hałasiewicz 2010]. Nowadays, this concept is not sufficient, mainly due to significant limitations resulting from the greater degree of openness of economies and, at the same time, the progressive degree of international transactions made. As Iwona Szczepaniak [2012] points out, in the case of an open economy, food self-sufficiency is perceived as the ability of the entire economy to cover domestic demand for food, while taking into account the possibilities of foreign exchange of the product.

Food self-sufficiency is closely related to the economic determinants of food security and is currently the top priority of many governments [Carson 2020]. Ensuring a sufficient amount of food available to every citizen of the country is undoubtedly one of the most important problems of the modern world, where the occurrence of extreme poverty, defined as the subsistence minimum, poses a serious threat to economic access to food for this group of consumers [Kozłowska-Burdziak 2019]. Economic access to food should be conditioned by the level of household income, where obtaining food should not expose people to failure to satisfy other basic needs [Poczta-Wajda 2018, Szczepaniak 2018].

One of the key agricultural markets in the European Union is the cow's milk market [Bórawski, Kowalska 2017]. From a nutritional point of view, cow's milk is an important

source of nutrients for all age group of consumers [Kowalska et al. 2019]. Various factors determine the production volume of this raw material. One of them is the condition of owned livestock buildings and their equipment. In European Union countries, farms involved in the production of cow's milk are modernized, and the developing technology is now able to provide farmers with a constant flow of information on animal health and welfare parameters [Barkema et al. 2015]. At the same time, it should be emphasized that the welfare of dairy cattle is an important issue for civil society [Nalon, Stevenson 2019]. Sanitary and veterinary regulations are an important factor that hinders the production of cow's milk [Gornowicz 2003]. Another limitation, which lasted until the end of May 2015, was the adjustment of the production volume to specific milk quotas. Their creation in the mid-1980s was aimed at stabilizing the market by eliminating the surplus of dairy products. As research indicates Krzysztof Firlej, Sebastian Kubala and Matuesz Mierzejewski: „the abolition of the system resulted in the search for new opportunities for milk producers, manifested by an increase in production, closer integration or an increased use of EU instruments to increase income" [Firlej et al., p. 502]. An important determinant is at the same time the close connection of the cow's milk market with the situation on the cereals market. A smaller harvest of cereals may have a significant impact on the level of costs associated with the purchase of feed, and, consequently, on the profitability of keeping cattle.

These issues raise the basic question, what is the level of self-sufficiency of cow's milk production in individual countries of Central and Eastern Europe? This question is extremely important in several respects. Firstly, one of the most important events in the history of the European Union is the accession of countries located in the central-eastern part of the European continent. This event opened up new markets for agricultural producers. On the other hand, this issue seems to be particularly important from the point of view of the prospects for the development of the cow's milk market. Third, the conflict between Russia and Ukraine brought back the problem of ensuring an adequate level of

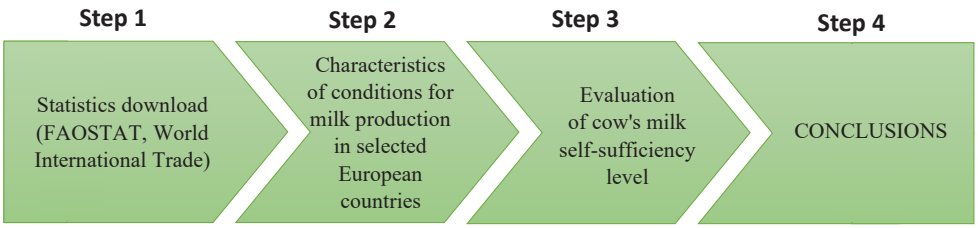

Figure 1. Research methodology
Source: own study

food in individual countries. The issues presented above contributed to the analysis of food self-sufficiency, where the main objective of the research was to try to assess the level of cow's milk self-sufficiency in selected countries of Central and Eastern Europe. In connection with the implementation of the research objective, a research methodology was formulated, the steps of which are illustrated in Figure 1.

RESEARCH MATERIAL AND METHODS

Thirteen countries from the region of Central and Eastern Europe were accepted as the research area. Eleven of them belong to the structures of the European Union: Bulgaria, Croatia, the Czech Republic, Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia and Hungary. At the same time, the results were compared with two countries belonging to the region of Central and Eastern Europe affected by the armed conflict: Russia and Ukraine.

The study used simplified indicators of food self-sufficiency, referring to the measures proposed by Krystyna Szybiga [2013] and Franciszek Kapusta [2011]. The research focused on technical and economic self-sufficiency. Technical self-sufficiency included the volume approach to the foreign trade balance and the conversion of indices representing the relation of the production volume per number of inhabitants and the volume of cow's milk consumption in relation to the production volume. Economic self-sufficiency was based on the study of the balance of foreign trade in terms of value.

The study was conducted for the years 2015-2020 for the considered countries of Central and Eastern Europe. With regard to the indicator based on the consumption of cow's milk, it was limited to 2015-2019 due to limited statistical material. The choice of the starting date for the research period was influenced by substantive issues, as the starting date is the first year after the abolition of milk quotas. The research used statistical data from databases such as FAO and World International Trade. The research results were presented in tabular and graphical form, and the methods used were descriptive analysis and comparative research.

RESULTS

In the first place of the conducted research, the conditions for milk production in the analyzed countries of Central and Eastern Europe were analyzed (Table 1). It should be noted that between 2015 and 2020, only in 7 countries an increase in the volume of cow's milk production was observed (including in 6 countries belonging to the European Union structure). In turn, the decrease in production volume occurred in Bulgaria,

Table 1. Characteristics of the conditions for milk production in the countries of Central and Eastern Europe in 2015 and 2020

Country	Milk production [thousand tons]		Number of dairy cows [thousand pieces]		Milky performance [tons/pieces]	
	2015	2020	2015	2020	2015	2020
Bulgaria	1,028.04	881.76	295.37	241.94	3.48	3.64
Croatia	694.40	596.00	155.10	110.00	4.48	5.42
Czech Republic	3,025.88	3,267.73	368.23	357.01	8.22	9.15
Estonia	782.70	848.30	95.60	84.30	8.19	10.06
Hungary	1,941.33	2,014.33	255.00	226.00	7.61	8.91
Latvia	975.36	988.20	165.87	136.04	5.88	7.26
Lithuania	1,734.73	1,488.00	314.04	232.90	5.52	6.39
Poland	13,236.23	14,821.82	2,279.23	2,125.70	5.81	6.97
Romania	4,005.99	3,679.60	1,188.20	1,139.80	3.37	3.23
Slovakia	948.71	917.69	143.08	122.05	6.63	7.52
Slovenia	630.58	630.65	107.84	99.21	5.85	6.36
Russia	30,521.69	31,959.80	7,362.34	6,571.60	4.15	4.86
Ukraine	10,359.40	9057.97	2,231.60	1,765.60	4.64	5.13

Source: own study based on data from the FAOSTAT

Croatia, Lithuania, Romania, Slovakia and Ukraine. The main reason for this tendency was the decreased profitability of the production of this agricultural raw material. The number of dairy cows between 2015 and 2020 decreased in all analyzed countries. The greatest decrease in this value was observed in Croatia and Lithuania (respectively by 29.08% and 25.84%). Nevertheless, milk yield improved among 12 of the 13 countries considered (except Romania). As presented by a team of researchers, Roel Jongeneel and Ana Gonzalez-Martinez [2022], such a result may be related to the abolition of milk quotas, which allowed the size of farms to be adjusted towards the optimal size, which had a positive impact on milk productivity. The highest increase in the value of this indicator was recorded in Estonia, Croatia and Poland (by 22.83%, 20.98% and 19.97%, respectively). The main reasons for increasing the level of milk efficiency include: modernization and restructuring of the raw material base of the dairy industry, improvement of dairy cattle genetics, as well as increasing the quality of feed used in animal production.

The first stage of the research on the level of self-sufficiency was the assessment of the indicator presenting the volume of cow's milk production per capita in individual countries of Central and Eastern Europe.

The values of the cow's milk production index per capita are characterized by significant disproportions (Table 2). Estonia was characterized by the highest level of the indicator in all analyzed years, followed by Lithuania and Latvia. In turn, the lowest values (below 200 kg/capita) were recorded in Bulgaria, Croatia, Slovakia and Romania.

Observing the level of dynamics, between 2015 and 2020 in more than half of the countries a decrease in the volume of cow's milk production per capita was recorded. This situation occurred in 7 countries. The largest decrease in the production of cow's milk per capita between 2015 and 2020 was recorded in Bulgaria, then in Croatia, Lithuania and Ukraine (increase in the value of the indicator by 11.21%, 10.85%, 10.84% and 10.54%). At the same time, a downward trend was observed in countries such as Romania, Slovakia and Slovenia. This situation is mainly related to a decrease in the

Table 2. Cow's milk production volume per capita in individual countries of Central and Eastern Europe in 2015-2020

Country	Cow's milk production [kg/person]					
	2015	2016	2017	2018	2019	2020
Bulgaria	143.22	142.90	136.83	127.94	117.88	127.16
Croatia	165.19	160.65	157.21	151.18	147.35	147.26
Czech Republic	286.92	290.05	290.64	297.42	295.71	305.43
Estonia	595.02	594.85	599.69	602.81	618.59	637.31
Hungary	197.23	195.46	201.01	199.36	200.88	206.60
Latvia	493.22	501.91	513.83	508.62	511.49	519.68
Lithuania	597.17	566.16	553.90	559.70	553.81	532.44
Poland	348.45	348.81	350.35	373.17	382.00	390.55
Romania	202.16	200.70	194.71	195.01	189.10	190.79
Slovakia	174.92	176.29	171.59	166.08	165.79	168.11
Slovenia	305.58	314.61	313.58	303.26	298.33	300.29
Russia	211.81	204.58	207.07	210.03	215.37	221.78
Ukraine	229.42	225.24	229.32	220.19	212.85	205.23

Source: own study based on data from the FAOSTAT

number of cows, with a simultaneous insufficient increase in milk yield. In turn, the highest increase in the volume of cow's milk production per capita between 2015 and 2020 was recorded in Poland, Estonia and the Czech Republic (increase in the value of the indicator by 12.08%, 7.11% and 6.45%).

Another important aspect relating to the proper assessment of the level of self-sufficiency of cow's milk is the reference to the trade balance in terms of value (economic self-sufficiency) and individual (technical self-sufficiency).

Cow's milk is easily perishable, which significantly limits the possibilities of making foreign transactions. Trade is mostly between developed countries, which are the main exporters of this agricultural raw material. The countries belonging to the European Union play a special role in it, however, the main direction of transactions is the intra-Community market, within which this raw material does not exceed the limits of the Common Customs Tariff. At the same time, attention should be paid to the political aspect in creating trade in cow's milk. The introduction of an embargo by Russia on products from the European Union was of significant importance in the transactions, which was particularly visible in the decline in cow's milk transactions in most countries belonging to the European Union in 2016. Another important factor contributing to the decline in the value of exports of this agricultural raw material were lower export prices.

The surveyed countries are both exporters and importers of cow's milk. Most Central and Eastern European countries export them rather than import them (Table 3), which may be related to the good conditions of dairy production in this region [Klopčič et al. 2019]. In terms of value, the trade balance surplus in 2015-2020 was recorded by: the Czech Republic, Poland, Slovenia, Hungary, Estonia, Latvia, Slovakia, Ukraine and Lithuania (except for 2019 and 2020). The highest level of the surplus in 2020 occurred in the Czech Republic (Euro 299, 413 thousand) and in Poland (Euro 269,633 thousand). The next highest result for Slovenia was over 3 times lower. In turn, the highest negative foreign trade balance in terms of value was recorded in Russia, followed by Croatia and Romania.

An upward trend in the trade balance of cow's milk in value terms between 2015 and 2020 was recorded in 6 countries: Estonia (113.32%), Poland (58.03%), Latvia (50.87%), the Czech Republic (24.01%), Hungary (14.41%) and Slovenia (8.74%). The largest decline in value during this period was observed in Bulgaria, Romania and Croatia.

Similar tendencies occur in the trade balance of cow's milk in terms of quantity. A surplus of exports over imports is in the Czech Republic, Estonia, Hungary (data available only for 2015), Latvia, Poland, Slovakia, Slovenia, Russia and Ukraine. The remaining countries annually record a negative balance of foreign trade in cow's milk. Positive trends in trade flows between 2015 and 2020 occur for the Czech Republic, Estonia, Latvia, Polish, Slovenia and Russia.

Table 3. Balance of foreign trade in cow's milk in individual countries of Central and Eastern Europe in terms of value and unit in 2015-2020

Country	Balance of foreign trade in cow's milk [thousand Euro]					
	2015	2016	2017	2018	2019	2020
Bulgaria	-10,499	-21,496	-24,922	-19,795	-19,757	-24,788
Croatia	-46,947	-52,981	-75,052	-73,475	-78,368	-65,389
Czech Republic	241,451	197,317	277,792	308,993	302,662	299,413
Estonia	32,039	43,881	67,029	62,061	67,310	68,347
Hungary	73,685	68,983	92,282	88,571	77,202	84,300
Latvia	40,012	35,968	73,126	61,458	58,807	60,368
Lithuania	26,563	24,253	32,756	6,844	-19,911	-34,214
Poland	170,617	149,197	224,758	233,186	264,201	269,633
Romania	-41,996	-52,050	-68,659	-51,100	-51,439	-63,074
Slovakia	42,029	32,692	25,549	17,245	12,351	2,717
Slovenia	82,461	76,764	86,169	85,039	90,860	89,666
Russia	-126,655	-111,609	-166,465	-134,636	-170,152	-147,984
Ukraine	3,414	3,946	7,338	10,725	10,483	299
Unit values [tons]						
Bulgaria	-28,617	-57,684	-45,025	-38,187	-36,201	-48,304
Croatia	-150,830	-170,904	-134,896	-194,165	-193,422	-175,790
Czech Republic	780,411	732,228	785,307	853,670	840,333	883,664
Estonia	137,489	198,098	201,658	185,030	200,632	211,216
Hungary	303,111	.	.	.	.	.
Latvia	224,757	175,184	200,204	229,231	222,513	239,255
Lithuania	-169,226	-208,005	-296,480	-330,729	-321,593	-360,666
Poland	301,774	351,648	396,471	454,099	607,914	656,923
Romania	-117,101	-143,557	-148,013	-120,548	-124,268	-151,741
Slovakia	128,378	110,908	70,349	51,131	62,051	56,813
Slovenia	252,257	272,815	268,482	257,958	250,310	258,924
Russia	197,939	186,228	279,756	227,197	223,960	226,436
Ukraine	8,426	9,903	13,225	19,495	21,608	5,640

Source: own study based on data from the World International Trade

Table 4. Cow's milk consumption rate per production volume in individual countries of Central and Eastern Europe in 2015-2019

Country	Cow's milk consumption rate				
	2015	2016	2017	2018	2019
Bulgaria	0.94	0.99	1.04	1.11	1.13
Croatia	1.32	1.32	1.39	1.43	1.52
Czech Republic	0.48	0.49	0.50	0.47	0.49
Estonia	0.48	0.45	0.46	0.48	0.45
Hungary	0.83	0.85	0.84	0.81	0.81
Latvia	0.34	0.33	0.35	0.34	0.32
Lithuania	0.17	0.18	0.20	0.20	0.20
Poland	0.48	0.48	0.47	0.46	0.48
Romania	1.15	1.17	1.19	1.21	1.21
Slovakia	0.81	0.98	0.97	1.00	1.03
Slovenia	0.45	0.43	0.45	0.46	0.50
Russia	0.61	0.65	0.65	0.66	0.66
Ukraine	0.63	0.63	0.63	0.72	0.80

Source: own study based on data from the FAOSTAT

The differentiation of the volume of cow's milk consumption in relation to the production volume for 2015-2019 is presented in Table 4. Most countries are characterized by surpluses of cow's milk production in relation to local needs, which is confirmed by the research of Özge Can Niyaz [2016], stating that the EU is self-sufficient in, among others, in the dairy group. In the case of this study, significant self-sufficiency was characterized by: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia (in 2015-2018), Slovenia, Russia and Ukraine. The local needs could be met to the smallest extent by: Croatia, Romania, Bulgaria (in 2017-2019) and Slovakia (in 2019).

Only in four countries the negative trend in shaping the indicator is not visible, which is the result of a significant reduction in the volume of cow's milk production in other countries. The greatest improvements in self-sufficiency for cow's milk occurred in Estonia, Latvia and Hungary. In Poland, this level remains at the same level as in 2015. In turn, the largest decrease in the level of the indicator between 2015 and 2019 was recorded in Slovakia, Ukraine and Bulgaria.

CONCLUSIONS

The cow's milk market is one of the most developed food markets not only in the countries of Central and Eastern Europe, but also in the entire European Union. Based on the calculations of individual indicators relating to the level of self-sufficiency, the countries of Central and Eastern Europe are characterized by a significant degree of differentiation in terms of self-sufficiency. On their basis, the following conclusions were drawn:

1. The abolition of milk quotas in 2015 in the European Union countries did not result in a significant increase in the volume of cow's milk production. An upward trend occurred only in the Czech Republic, Estonia, Hungary, Latvia, Poland and Slovenia. The abolition of milk quotas by the European Union resulted in the gradual restoration of dairy herds by these farmers. At the same time, an increase in milk yield was observed in all the considered Central and Eastern European countries (except Romania) between 2015 and 2020.
2. Most of the Central and Eastern European countries under consideration have a safe cow's milk food policy. The level of domestic production of this raw material is therefore able to meet local demand. These include countries such as the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia, Russia and Ukraine. The lowest degree of self-sufficiency of cow's milk production is in Bulgaria, Croatia and Romania.
3. Countries belonging to the structure of the European Union play a special role in trade in cow's milk. Most CEE countries export rather than import this raw material. However, the main direction of the transactions made is the intra-Community market.

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OCENA POZIOMU SAMOWYSTARCZALNOŚCI PRODUKCJI MLEKA KROWIEGO W KRAJACH EUROPY ŚRODKOWO-WSCHODNIEJ

Słowa kluczowe: rynek mleka krowiego, produkcja, konsumpcja, handel międzynarodowy, Europa Środkowo-Wschodnia

ABSTRAKT. Samowystarczalność żywnościowa uznawana jest za jeden z podstawowych priorytetów funkcjonowania współczesnych gospodarek żywnościowych. Głównym celem opracowania jest ocena poziomu samowystarczalności produkcji mleka krowiego w wybranych krajach Europy Środkowo-Wschodniej. Za obszar badawczy przyjęto trzynaście państw regionu Europy Środkowo-Wschodniej. W badaniu posłużono się uproszczonymi wskaźnikami samowystarczalności żywnościowej. Samowystarczalność techniczna objęła ujęcie wolumenowe bilansu handlu zagranicznego oraz przeliczenie wskaźników, stanowiących relację wielkości produkcji w przeliczeniu na liczbę mieszkańców oraz wielkość spożycia mleka krowiego w relacji do wielkości produkcji. Samowystarczalność ekonomiczną oparto na badaniu bilansu handlu zagranicznego w ujęciu wartościowym. Badanie przeprowadzono dla danych za lata 2015-2020. Wyniki badań wskazują, że kraje Europy Środkowo-Wschodniej charakteryzują się znacznym stopniem zróżnicowania pod względem samowystarczalności produkcji mleka krowiego. Większość rozpatrywanych państw prowadziło bezpieczną politykę żywnościową tego surowca rolnego. Najniższy stopień samowystarczalności produkcji mleka krowiego występował w Bułgarii, Chorwacji i Rumunii. Ponadto stwierdzono, że zniesienie kwot mlecznych w 2015 roku w krajach Unii Europejskiej nie spowodowało znaczącego zwiększenia wielkości produkcji mleka krowiego.

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