

ASSESSMENT AND RELATIONSHIPS BETWEEN PHYSICAL AND ECONOMIC ACCESSIBILITY OF FOOD: STATUS AND FORECAST

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Abstract

The article discusses various aspects of food security: the level of self-sufficiency, physical and economic accessibility of food. Methodical approaches to the assessment of food security are proposed: the physical availability of food through the coefficient of sufficiency of consumption of basic types of food (meat, milk, vegetables), economic affordability through the share of food costs in household expenditures. The values of various levels (permissible and critical) of food availability are substantiated. Based on the regression analysis, factors determining the physical and economic accessibility of food have been identified. The forecast of the level of achievement of the criteria of food security was fulfilled, which made it possible to estimate the timeframe and resource possibilities in terms of the main types of food. The dependence of the adequacy of consumption of basic food products to a greater degree on the increase in domestic production than on the external content of the food market has been revealed. It has been proven that physical accessibility does not always mean the economic accessibility of food. The degree of differentiation of individual subjects of the Volga Federal District of the Russian Federation on the level of economic and physical accessibility of food has been evaluated. It is concluded that there is an interconnection between various aspects of food security. The results of the study can be used to justify the priorities of the agri-food policy.

Key words: food security, physical accessibility of food, economic affordability of food, self-sufficiency, agricultural and food policy

INTRODUCTION

Among the global problems of the modern world, the food problem is most acute, since the national security, political and economic sovereignty of any state depends on its solution. As noted in the documents of the Food and Agriculture Organization of the United Nations (FAO), over the past two decades the world has made great strides in the fight against hunger and malnutrition. However, despite the progress achieved, this problem is far from being resolved. "The human, social and economic cost of hunger, food insecurity and malnutrition for society is enormous and has far-reaching consequences: reduced productivity, health problems, declining levels of well-being, impaired learning ability, incompletely revealed human potential and social and political unrest undermining development efforts " [9].

Of course, the problem of hunger for Russia is not relevant. However, low caloric intake, a high proportion of food expenditures in household expenditures, irrational consumption patterns, significant differentiation of these indicators by social groups and regions set the task of enhancing measures to solve the problem of physical and economic accessibility of food. In addition to the food security doctrine of the Russian Federation, adopted in 2010, the main components, in addition to food independence, also determine the economic and physical availability of food. However, the focus is on achieving the level of self-sufficiency in basic foodstuffs and the target parameters for achieving food independence are defined. Other aspects that relate to the physical, economic accessibility of food, food quality, although fixed, but do not have clear parameters and criteria for achieving them.

Food security as a multi-criteria category is considered in the interaction of its aspects. Achieving some aspects can reduce the level of achievement of others. This is clearly illustrated by the current policy of import substitution [16]. The decrease in the share of imports occurs against the background of a decrease in the physical and especially economic accessibility of food [13].

Therefore, an urgent task is to clarify the methodological basis for assessing the achievement of food security, which will make it possible to predict and determine the time frame and ways to achieve it to achieve it.

The purpose of the study is to systematize the factors determining food security and, above all, the physical and economic accessibility of food, develop approaches to quantify them, predict the situation with the achievement of the main parameters of food security as a multi-criteria category and justify measures to solve the most acute problems.

The problems of food security are devoted to the activities of international organizations that continuously monitor its condition in all aspects - food independence, physical and economic accessibility [8].

To ensure food security in the context of implementing sustainable development goals, FAO helps attract public and private sector investment in agri-food systems [6]. and improve efficiency, strengthen the capacity of the agri-food value chain in technical and management areas [5] access financing and increase sustainability, efficiency and inclusiveness such chains [10].

The works of domestic and foreign scientists are devoted to the problems of food security: Altukhova A. [1], Anfinogentova A. [2], Golubev A. [12], Krylatykh E. [15], Serova E., Shagaydy N., Uzuna V., Ushacheva I., Yakovenko N., P.J. Ericksen, J.S.I. Ingram, D.M. Liverman, (2009) [7] Godfray H.C., Crute I.R., Haddad L. (2010) [11] Bauer W. (1972) [3] etc. Scientific teams of leading scientific institutions are engaged in monitoring, assessing the state of food security in Russia (ARIAPI named after Nikonov, ARSRIACE [20] Institute of Agrarian problems RAS, etc.).

Features of the development of food problems are highlighted in the works of Belaya V., Hanf, J.H. (2016) [4] Pall Z., Perekhozhuk O., Glauben T., Prehn S., Teuber R. [17].

MATERIALS AND METHODS

Quantitative and qualitative measures of food safety should be highlighted. Most often, researchers turn to the analysis of indicators characterizing the state of agricultural production. Without denying the importance of these indicators, we note that food safety is also shaped by other equally important factors: the technological level of processing and food production, the development of the trading and transport infrastructure of the food market, the income level of the population [14].

In the works of leading Russian scientists the most important problem is designated - the organization of monitoring the state of food security of the Russian Federation and the methodology for such an assessment is developed. As indicators and indicators, it is proposed to use such the level of self-sufficiency (independence) for the most important types of agricultural products, a summary indicator of food independence, the level of rational achievement, energy and nutritional value of the ration, economic accessibility) [21].

Based on this approach, which covers a wide range of indicators, the authors propose to use a comprehensive methodology that includes a limited number of indicators that reflect all aspects of food security: the level of self-sufficiency; coefficient the sufficiency of consumption by main types of food; food availability ratio. The calculations were made for the types of food that are most critical for solving the problems of food security - meat, milk, vegetables.

The coefficient the sufficiency of consumption by type of food is the ratio of the actual volume of consumption to the volume corresponding to rational norms. The proximity of the coefficient the sufficiency of consumption to 1 indicates the optimal level of consumption. And the approach of consumption to the volume established by the

medical requirements of consumption in the minimum consumer basket indicates a critical level of this indicator.

Rational food consumption standards that meet modern requirements for healthy nutrition are the average per capita values of the main food groups in kilograms per capita per year, which take into account the chemical composition and the energy value of food, provide the estimated per capita demand for nutrients and energy, as well as variety of food consumed. Rational consumption of meat and meat products - 73 kg, milk and

dairy products - 325 kg, vegetables - 140 kg [19]. The minimum marginal level of consumption adequacy ratio for Russia in 2018 was: for meat 0.75, for milk 0.9, for vegetables 0.8 (Table 1).

To identify the factors determining the physical and economic accessibility of food, the methods of statistical (regression) analysis are used, making it possible to predict the level of attainment of food safety criteria - to assess the time frame and resource capabilities in the context of "critical" food types.

Table 1. Calculation of the minimum level of consumption adequacy ratio

	Rational consumption rate, kg	Volume in the minimum consumer basket, kg			Minimum level of consumption ratio
		able-bodied population	pensioners	children	
Meat and meat products	73	58.6	54.0	44.0	0.75
Milk and dairy products	325	290	257.8	360.7	0.90
Vegetables	140	114.6	98.0	112.5	0.80

Source: Own determination.

The coefficient the sufficiency of consumption depends on the factors: import, production, consumption, export, the area under crops (or livestock), yield (or productivity).

Food availability ratio is the ratio of the cost of a consumer (food basket) to the average per capita income of a population. Food availability ratio depends on factors:

- the proportion of the population with incomes below the subsistence minimum;
- the consumer price index for food;

- population income index;
- the level of economic activity of the population.

RESULTS AND DISCUSSIONS

It is necessary to note certain successes in solving one of the tasks of achieving food security - self-sufficiency in basic foodstuffs. The import substitution policy implemented since 2014 has led to a significant reduction in food imports.

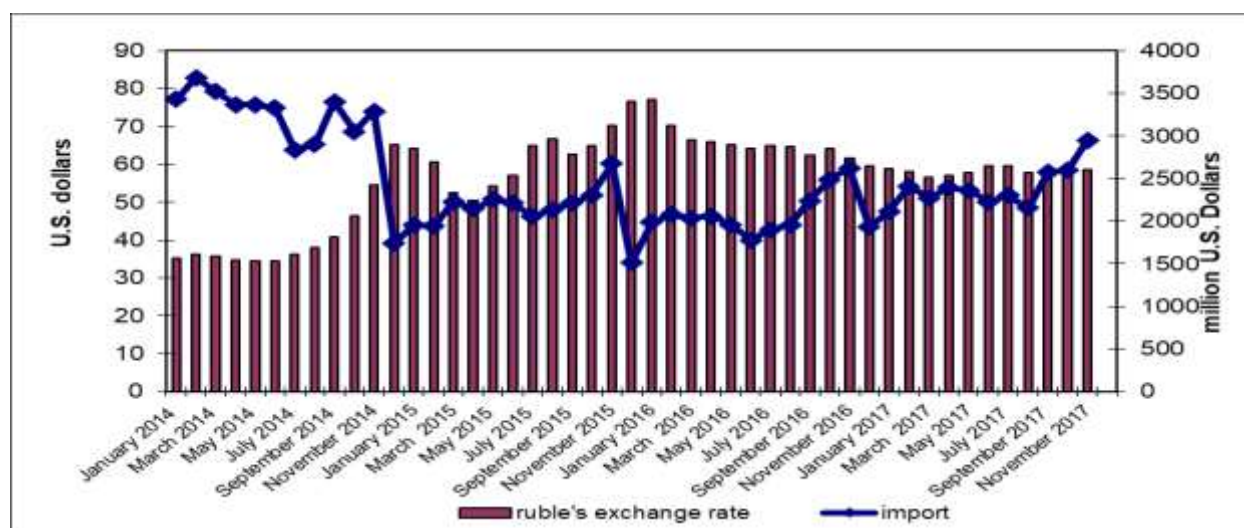


Fig. 1. The dynamics of the ruble exchange rate and the import of food and agricultural raw materials in the Russian Federation in 2014-2017

Source: Own determination.

In 2014, a clear decline in imports was evident, which was associated with the introduction of the food embargo, as well as the weakening of the ruble exchange rate against the currencies of the main trading partners [22].

By the end of 2016, there was a further, even more significant reduction in food imports due to a significant devaluation of the ruble (Fig. 1).

In 2017, imports of food and agricultural raw materials decreased by a third compared with 2013. At the same time, in 2017 compared to 2016, there is an alarming upward trend in imports in dollar terms (by 15%).

Russia continues to be a stable net importer of food and agricultural raw materials. Imports in 2017 exceeded the export almost 1.4 times (Fig. 2).

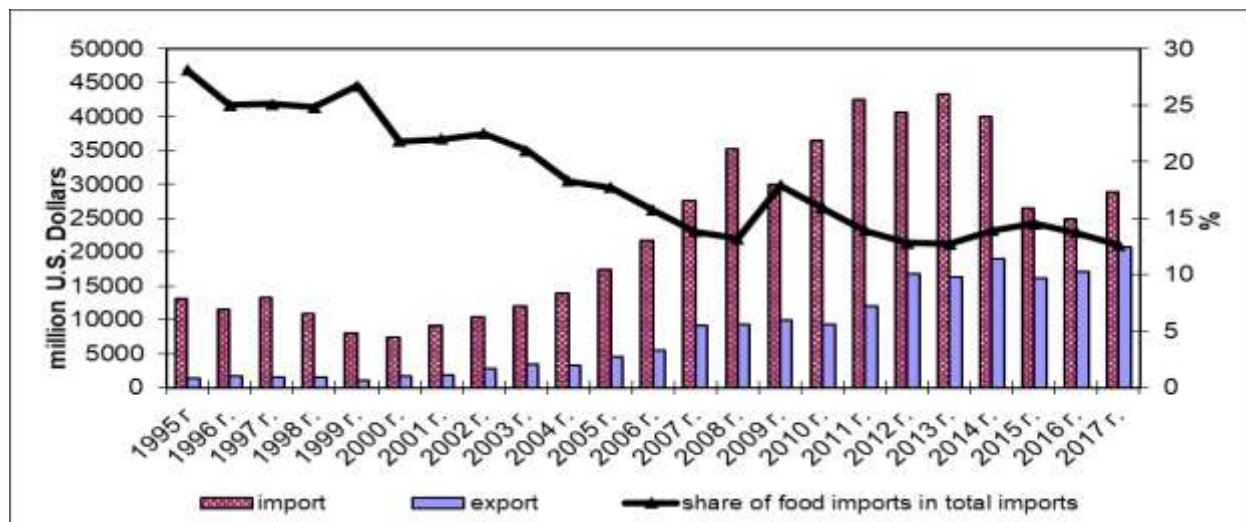


Fig. 2. Dynamics of import and export of food and agricultural raw materials in the Russian Federation in 1995-2017

Source: Own determination.

The share of domestic production of meat and meat products was in 2017 84.4% with a target determined by the Doctrine of Food Security of the Russian Federation at 85%. Almost entirely at the expense of domestic production ensured the consumption of pork, poultry meat. However, significant imports in resources for such types of products as animal butter (24%), cheeses - 27%, vegetables - almost 39%, remain.

If in achieving food independence and increasing self-sufficiency, there are traced, albeit small, positive trends, the situation with the physical and economic accessibility of food has worsened.

The structure of consumption remains inadequate for rational consumption rates. The consumption of milk and dairy products is 71% in relation to the rational rules, vegetables - 76%, fruits and berries - 59%.

The decrease in the import intensity of the agrarian sector was accompanied by a rise in

food prices and an increase in the share of food expenditures in consumer spending of the population (Fig. 3.)

An analysis of the economic affordability of food in foreign countries shows that the higher the level of development of the national food system and the more it is integrated into world economic relations, the smaller the share of food expenditure in the expenditures of the population (no more than 15%). In 2018, the share of expenditures on food in household expenditures was 30%. Food availability naturally depends on the income level of the population. Thus, the cost of food, depending on the level of average per capita disposable resources, by 10 percent (decile) groups of the population differs almost 4 times in 2018 in the first and tenth groups.

Summarizing the analysis of the achievement of food safety criteria, including its various aspects, it should be concluded that there is a

need for more in-depth research of the factors determining the interrelation and mutual

influence of such factors as own production, imports, production resources.

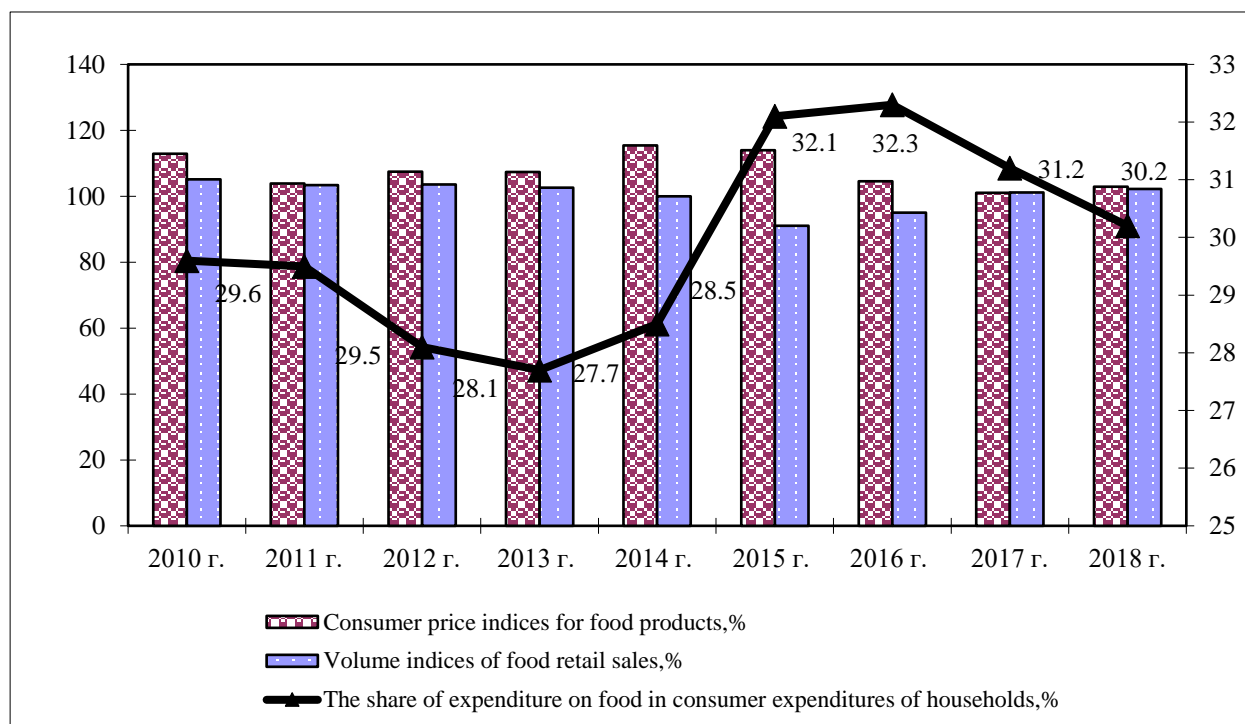


Fig. 3. The dynamics of food prices, retail sales of food products and the share of food expenditures in household consumption expenditures

Source: Own determination.

For this purpose, calculations of the coefficient of sufficiency and availability of food were made using the example of the regions of the Volga Federal District (VFD) of the Russian Federation.

In terms of its development indicators, the VFD agrarian sector is close to the average Russian values. Many regions of the Volga Federal District are characterized by a fairly high level of development of agriculture and food industries. This enables their integration into the national and world food market. At the same time, the VFD regions are significantly differentiated by the standard of living of the population. Against the background of the more prosperous subjects of the Volga Federal District (the Republic of Tatarstan and the Nizhny Novgorod region), the Republic of Mari El, Mordovia, Chuvashia and the Saratov region look more backward.

Data to predict the adequacy of consumption of meat and meat products are given in Table 2.

If, in Russia as a whole, the consumption adequacy ratio is evidence of a completely satisfactory picture, then in the PFD as a whole, as well as in a number of regions (Perm Krai, Kirov, Saratov, and Ulyanovsk Regions), this indicator is lower than one, which indicates an insufficient level meat consumption and meat products. However, the volume of meat consumption does not reach a critical level (0.75) and exceeds the minimum volume provided by the consumer basket.

The application of the regression analysis method to the initial data presented in the table allowed us to obtain the following relationship:

$$\text{Meat} = 1.03 + 0.0014 * X1 - 0.0029 * X2 + 0.0001 * X3 - 0.0007 * X4 - 0.0006 * X5 + 0.0046 * X6,$$

where:

Kmyas. - the coefficient of sufficiency of consumption of meat and meat products;
 X1- production of meat and meat products per capita, kg;

X2 - the share of import and import in meat resources,%;
 X3 - cattle livestock per 1000 people. population, heads;
 X4 - the number of pigs per 1000 people. population, heads;
 X5 - the number of sheep and goats per 1000 people. population, heads;

X6 - feed consumption per 1 kg of cattle weight gain, feed units.
 The analysis of the obtained dependence showed that the adequacy of meat consumption is largely determined by the level of its domestic production.

Table 2. Data to predict the adequacy of consumption of meat and meat products

Regions	Sufficiency ratio of meat consumption	Production of meat and meat products per capita, kg	Share of import and import in meat resources,%	Livestock per 1,000 people. population, heads			Feed consumption per 1 kg of cattle weight gain, unit
				Cattle	Pigs	Sheep and goats	
Russian Federation	1.027	70.3	10.4	124.6	157.2	166.1	14.43
Volga Federal District	0.986	70.4	31.8	173.22	120.20	98.88	14.33
Rep. of Bashkortostan	1.068	65.9	22.9	252.97	115.11	201.86	17.16
Mari El Republic	1.301	294.7	5.0	111.02	373.92	55.38	11.71
The Rep. of Mordovia	1.068	265.9	18.0	266.20	444.14	54.48	15.01
Republic of Tatarstan	1.110	84.0	23.3	264.06	118.40	91.69	14.02
Udmurt Republic	0.959	76.9	17.3	227.65	147.65	51.06	11.91
Chuvash Republic	0.932	68.8	30.9	156.48	115.61	136.24	11.08
Perm region	0.863	27.2	59.2	90.94	52.14	29.95	13.18
Kirov region	0.918	42.6	47.7	186.60	152.12	32.72	11.41
Nizhny Novgorod Region	1.096	32.6	55.5	80.34	52.55	22.15	15.96
Orenburg region	0.959	72.2	27.5	285.71	142.30	165.72	17.74
Penza region	1.027	163.8	21.6	124.61	152.08	80.30	14.50
Samara region	0.904	35.2	48.5	71.36	52.33	45.98	18.86
Saratov region	0.808	49.7	42.1	171.37	114.21	228.64	16.52
Ulyanovsk region	0.863	34.0	50.4	94.71	167.61	64.48	13.53

Source: Own determination.

At the same time, an increase in the share of imports in meat resources negatively affects the availability of this product. The ruble, which sharply depreciated during this period, made imported products low-margin for processors and the HoReCa segment, which led to a decrease in its consumption. One should also take into account the fact that the prices of imported raw meat from those countries that fell under the embargo were, as a rule, lower than from the countries that ultimately remained in the list of importers. In this regard, a higher share of imports in the resources of meat and meat products indirectly affects the level of consumption. A

further possible reduction in the share of imports in the resources of meat and meat products will not have a significant impact on domestic consumption, since, unlike in previous years, it will not lead to price increases, given the increase in competition between domestic producers of poultry meat and pork.

Thus, the achievement of the criteria for the adequacy of the consumption of meat and meat products, taking into account the rational and actually established structure of consumption of meat products, is due to the growth of domestic production of beef. This circumstance should be taken into account

when justifying the priority directions of development of the meat-and-food subcomplex of Russia, to which should be included the increase in the number of cattle (cattle), the optimization of feeding rations. The level of sufficiency in meat consumption is most sensitive to the growth of the cattle population (Table 3). Growth in the number of pigs is less significant due to the relatively high rates of industry development and saturation of the domestic market in recent years, and sheep and goats due to the

insignificant share in the structure of consumed meat products.

The analysis revealed that to ensure full sufficiency of meat consumption for the population of the Volga Federal District, an additional production growth will be required in the amount of 296.4 thousand tons, which will be 14% compared to 2017. With the current growth rates of meat production (livestock and poultry in slaughter weight) in 1.8% per year it will require more than 7 years.

Table 3. Analysis of the sensitivity of the adequacy of meat consumption

	Production of meat and meat products per capita, kg	Share of import and import in meat resources, %	Livestock per 1,000 people. population, heads			Feed consumption per 1 kg of cattle weight gain, unit
			Cattle	pigs	Sheep and goats	
Regression coefficient	0.0014	-0.0029	0.0001	-0.0007	-0.0006	0.0046
Elasticity coefficient	0.1053	-0.0981	0.0216	-0.1102	-0.0543	0.0672

Source: Own determination.

An equally important problem is the achievement of the physical availability of milk and dairy products for the population

[18]. Data to predict the adequacy of the consumption of milk and dairy products are presented in Table 4.

Table 4. Data to predict the adequacy of the consumption of milk and dairy products

Regions	The ratio of the consumption of milk	Production of milk and dairy products per capita, kg	The share of import and import in the resources of milk, %	The number of cows per 1,000 people. population, heads	Feed consumption per 1 quintal of milk, feed units
Russian Federation	0.711	205.6	18.7	54.2	1.05
Volga Federal District	0.818	315.54	16.50	69.31	1.06
Republic of Bashkortostan	0.923	395.76	2.30	97.60	1.16
Mari El Republic	0.732	250.50	13.40	45.28	1.04
The Republic of Mordovia	0.769	520.02	3.90	94.06	1.01
Republic of Tatarstan	1.114	469.42	8.40	91.16	1.15
Udmurt Republic	0.818	503.32	10.90	88.85	0.98
Chuvash Republic	0.778	336.81	13.60	71.20	0.98
Perm region	0.708	183.64	41.30	38.99	1.04
Kirov region	0.815	497.22	4.30	73.92	0.88
Nizhny Novgorod Region	0.723	185.62	38.30	34.95	1.12
Orenburg region	0.932	355.88	5.10	123.14	1.08
Penza region	0.615	256.07	13.60	53.20	0.95
Samara region	0.748	141.78	47.40	33.69	1.06
Saratov region	0.711	287.16	14.20	76.93	1.28
Ulyanovsk region	0.628	159.86	28.80	37.06	0.82

Source: Own determination

As can be seen from the table, the level of sufficiency of consumption for milk and dairy products in both Russia and the PFD regions is generally lower than one, and 11 regions of the PFD reach a critical value (0.9). Compared to the consumption of meat and meat products, the situation with the consumption of milk and dairy products is characterized as more acute.

The application of the regression analysis method to the initial data presented in the table allowed us to obtain the following relationship:

$$Q_{mol.} = 0.102 + 0.0005 * X1 + 0.0035 * X2 + 0.0026 * X3 + 0.278 * X4,$$

where:

$Q_{mol.}$ - the coefficient of sufficiency of

consumption of milk and dairy products;
 $X1$ - milk production per capita, kg;
 $X2$ - the proportion of import and import in milk resources,%;
 $X3$ is the number of cows per 1,000 people. population, heads;
 $X4$ - feed consumption per 1 kg of milk, feed units

The level of sufficiency of consumption of milk and dairy products is also the most sensitive to the increase in milk production, which, in turn, depends on the number of cows and the technology used for the production of milk. The factor of growth in imports in milk resources, although it can affect the sufficiency of milk consumption, has a sensitivity of 2.5 lower than the growth factor of its own production (Table 5).

Table 5. Analysis of the sensitivity of the adequacy of milk consumption

	Production of milk and dairy products per capita, kg	Share of import and import in milk resources,%	The number of cows per 1,000 people. population, heads	Feed consumption per 1 kg of milk, feed units
Regression coefficient	0.0005	0.0035	0.00265	0.2781
Elasticity coefficient	0.1953	0.0786	0.2305	0.367

Source: Own determination.

In order to ensure the required level of sufficiency in the consumption of milk and dairy products, the volume of domestic production of milk must be increased to 11,035 thousand tons, or by 18%. However, the achievement of such indicators looks problematic against the background of declining livestock of cows (1.1% in PFD for 2017) and taking into account the current growth rates of milk production (1% in PFD in 2017). Extrapolation of the dynamics of milk production indicates that this will require more than 17 years. The way out of this situation can be an increase in the growth rate of the livestock of cows, an increase in productivity, the introduction of innovative technologies in the dairy-food subcomplex.

Dairy products and vegetables are the only categories whose consumption in Russia is lower than rational norms. A significant problem is the unbalanced diet of Russians, in particular, the low proportion of fruits and vegetables. In 2017, the consumption of

vegetables by residents of the Russian Federation was 107 kg, while the recommended rate was 140 kg. Data to predict the adequacy of vegetable consumption is presented in Table 6.

In almost all regions of the Volga Federal District, the coefficient of sufficiency of consumption is below the minimum level (0.8). The analysis showed a high level of differentiation of per capita production of vegetables, even within the VFD. Thus, the production of vegetables in the Orenburg region in 2017 exceeded the level of the Perm Territory by almost 8 times. The share of areas occupied by vegetable crops, rarely exceeds 1% in the structure of the sown areas of the Volga Federal district regions.

The application of the regression analysis method to the initial data presented in the table allowed us to obtain the following relationship:

$$Cove. = 0.19 + 0.0013 * X1 + 0.126 * X2 - 0.0007 * X3 + 0.0014 * X4 - 0.0006 * X5,$$

where:

Cove. - the coefficient of sufficiency of consumption of vegetables;
 X1- production of vegetables per capita, kg;
 X2 - the proportion of the sown area of vegetables,%;

X3 is the specific weight of import and import in resources of vegetables,%;
 X4 - yield of vegetables, kg / ha;
 X5 - application of mineral fertilizers per 100% of nutrients, kg.

Table 6. Data for predicting the adequacy of vegetable consumption

Regions	Sufficiency ratio of vegetable consumption	Production of vegetables per capita, kg	The proportion of sown area of vegetables,%	The share of import and import in the resources of vegetables, %	The yield of vegetables. centers per hectare	Application of mineral fertilizers per 100% nutrients, kg
Russian Federation	0.764	105.1	0.668	8.1	241	55
Volga Federal District	0.736	115.1	0.409	10.2	253	32.1
Republic of Bashkortostan	0.543	74.0	0.356	14.2	210	25.9
Mari El Republic	0.950	152.8	1.231	1.7	294	19.7
The Republic of Mordovia	0.629	111.1	0.684	3.4	159	68.1
Republic of Tatarstan	0.707	88.0	0.327	18.6	287	64.6
Udmurt Republic	0.807	89.1	0.415	4.2	319	19.9
Chuvash Republic	0.764	98.5	0.738	12.1	288	38.3
Perm region	0.721	52.5	0.650	17.8	293	17
Kirov region	0.757	60.3	0.281	26.4	314	27.6
Nizhny Novgorod Region	0.607	61.8	0.600	12.6	284	41.3
Orenburg Region	1.121	408.5	0.144	4.3	284	2.5
Penza region	0.679	121.5	0.500	1.6	230	63.2
Samara region	0.829	92.4	0.573	9.2	249	23.9
Saratov region	0.750	193.4	0.415	5.6	216	9.9
Ulyanovsk region	0.779	118.2	0.516	10.1	258	33.8

Source: Own determination.

Studies have shown that to achieve even the minimum sufficiency limit for vegetable consumption, it is necessary to increase their production in the Volga Federal District by 1,512.4 thousand tons (by 44% compared to the level of 2017). Providing such growth in the current situation in the vegetable subcomplex will require about 13 years. The sensitivity analysis of the level of sufficiency of vegetable consumption (Table 7) revealed that the main factor in increasing production volumes is the yield of vegetables.

It should be noted that the vegetable production market in Russia is formed mainly due to domestic production. The level of self-sufficiency in vegetables was 93.7%. Thus, we can draw the following conclusion. Ensuring the sufficient accuracy of consumption of such products as meat and meat products, milk and dairy products, vegetables directly depends on the increase in domestic production. However, the long period required to achieve the target indicators for the development of its own production

does not allow completely abandoning food imports. It should be noted that the availability of physical availability or sufficiency of consumption does not always mean the economic affordability of food.

According to the authors, the coefficient of food accessibility can be estimated as a share

of food expenditures in household consumption expenditures. The availability of food depends on factors: the share of the population with incomes below the subsistence minimum, the consumer price index for food, the income index of the population.

Table 7. Analysis of the sensitivity of the adequacy of consumption of vegetables

	Production of vegetables per capita, kg	The proportion of the sown area of vegetables, %	The share of imports and imports in the resources of vegetables, %	The yield of vegetables, centers per hectare	Application of mineral fertilizers per 100% nutrients, kg
Regression coefficient	0.0013	0.126	-0.0007	0.0014	-0.0006
Elasticity coefficient	0.2034	0.0867	-0.0096	0.4963	-0.0279

Source: Own determination.

To assess the impact of the sectoral structure of the regional economy, it is proposed to

include in the system of indicators the share of agriculture in GRP (Table 8).

Table 8. Data to predict the availability of food

Regions	The coefficient of availability (the share of food costs), %	Index of per capita income, %	Population with incomes below the subsistence minimum, %	The share of agricultural products in the GRP, %	Consumer price index for food products, %
Russian Federation	34.3	97.85	13.2	5.2	101.1
Volga Federal District	34.2	99.37	13.3	8.3	100.3
Republic of Bashkortostan	34.5	98.92	12.3	10.4	100.6
Mari El Republic	36.1	98.19	22.1	19.4	100.3
The Republic of Mordovia	41.4	97.97	18.6	20.2	100.5
Republic of Tatarstan	29.7	102.82	7.4	7.8	101.3
Udmurt Republic	30.9	99.82	12.2	6.8	100.0
Chuvash Republic	39.3	99.92	18.5	13.7	99.1
Perm region	31.4	99.13	14.9	3.3	100.2
Kirov region	35.2	98.81	15.7	16.4	99.9
Nizhny Novgorod Region	32.3	99.58	9.9	5.5	100.4
Orenburg region	32.2	97.12	14.6	8.8	100.7
Penza region	40.4	97.34	14.0	13.3	100.6
Samara region	34.4	99.30	13.4	4.5	99.5
Saratov region	43.9	97.91	16.8	15.0	99.0
Ulyanovsk region	39.0	97.20	14.9	10.9	101.4

Source: Own determination.

As a negative trend, it should be noted that the pace of growth in food prices is higher than the growth rate of incomes of the population. The most favorable situation in the Volga Federal District has developed only in

Tatarstan, where income growth (102.82%) outpaces price growth (101.3%). The same region demonstrates the best indicator of the economic affordability of food products: the share of food expenditures in the cost

structure is 29.7%. The differentiation of this indicator by regions of the Volga Federal District is significant - the gap between the limit values is about 1.5 (as in the Saratov region, the population spends almost 44% on food).

The application of the regression analysis method to the initial data presented in the table allowed us to obtain the following relationship:

$$Dost = 105,998 - 0,296 * X1 + 0,0074 * X2 + 0,3016 * X3 - 0,6628 * X4,$$

where:

Dost - the coefficient of availability (the share of food costs in the cost),%;

X1 is the index of per capita income,%;

X2 - population with incomes below the subsistence minimum,%;

X3 is the specific weight of agriculture in GRP,%;

X4 - consumer price index for food products,%.

As can be seen from Table 9, the per capita income index is more influenced by the availability of food. The growth of average per capita incomes of only 1% will lead to a reduction in the cost of food in the structure of household consumption expenditures by 0.82%.

Table 9. Analysis of the sensitivity of food availability

	Index of per capita income,%	Population with incomes below the subsistence minimum,%	The share of agricultural products in the GRP,%	Consumer price index for food products,%
The coefficient of pair correlation with food availability	0.5472	0.61434	0.69292	0.34635
Regression coefficient	-0.296	0.0074	0.3016	-0.6628
Elasticity coefficient	-0.8206	0.00302	0.0926	-1.8634

Source: Own determination

The analysis revealed the following pattern: in regions with a relatively high level of agricultural development and, accordingly, with a high proportion of agricultural products in GRP, the economic accessibility of food is lower. This can be explained by lower wages in the agricultural sector. Paradoxically, food availability depends on the consumer price index for food: a rise in the price index leads to a decrease in the share of food expenditures in the expenditure structure. This is due to the switching of consumer demand (especially among low-income groups of the population) to cheaper and lower-quality food, which represents a significant threat to the achievement of food security.

Studies have shown that the development of regional agro-food systems does not always ensure the achievement of all the criteria for food security, including the physical and economic accessibility of food. Thus, the Republic of Tatarstan is characterized by a

high level of physical and economic accessibility (Fig. 4).

For a number of subjects of the Volga Federal District, against the background of relatively low physical availability of food, high economic affordability was recorded (Perm Territory, Nizhny Novgorod and Samara Regions, the Republic of Bashkortostan, etc.). The application of the regression analysis method allowed us to reveal the interrelation between the indicators of physical and economic accessibility of food and to establish that with a reduction of 1 percentage point the share of food expenditure in the household expenditure structure increases the food consumption sufficiency ratio by 0.945.

Bringing the level of consumption of basic foodstuffs (meat, milk, vegetables) to the level recommended by rational food consumption standards will require a significant reduction in poverty and a corresponding reduction in the share of food expenditures in the household expenditure structure.

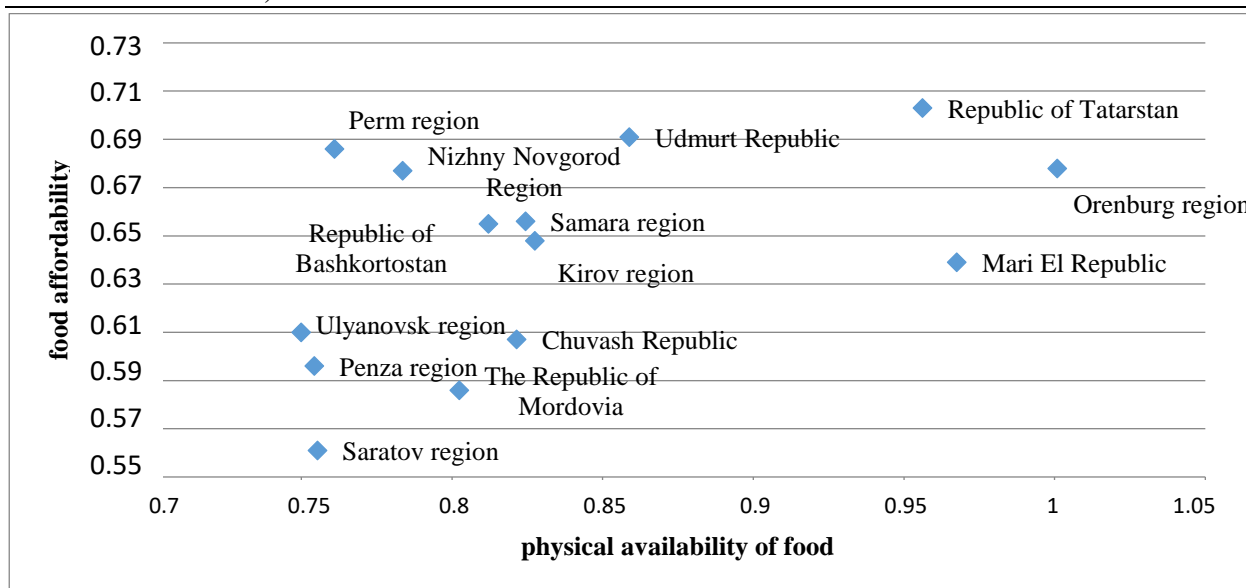


Fig. 4. Grouping of regions of the Volga Federal District by components of food security
 Source: Own determination.

If in 2017, on average, in the regions of the Volga Federal District, the share of food expenditures was 34.2%, then the decrease of this indicator is 17 pp. will improve the physical availability of food in accordance with modern requirements of healthy nutrition.

CONCLUSIONS

The study revealed the complex nature of food safety issues. Achieving food security involves achieving both physical and economic accessibility of food.

To identify the factors that determine the physical and economic accessibility of food products, we used regression analysis methods that allowed us to predict the level of attainment of food safety criteria — assess time frames and resource opportunities in terms of “critical” food types.

The analysis showed that physical accessibility or the level of adequacy of consumption depends on a number of factors: import (import) of food, production volumes, level of consumption of main types of food, factors of resource potential (area under crops, livestock, yield, productivity).

The calculations show that ensuring the adequacy of consumption of such products as meat and meat products, milk and dairy products, vegetables directly depends on the increase in domestic production. However, the

long period required to achieve the target indicators of the development of its own production does not allow completely to abandon food imports. It should be noted that the availability of physical availability or sufficiency of consumption does not always mean the economic affordability of food.

The economic affordability of food is estimated on the basis of the calculation of the ratio of food availability — the ratio of the cost of a consumer (food basket) to the average per capita income of the population. The food availability ratio depends on a system of factors: poverty level, price dynamics, and consumer incomes.

The study revealed a significant differentiation of the regions of the Volga Federal District: in terms of the physical availability of food, the difference between the maximum and minimum levels is 33%; on economic affordability respectively 25%. Solving the problem of the economic accessibility of food depends largely on the state’s social policy, which provides for an increase in the quality of life of the population and a reduction in the level of poverty. For this, it is necessary to improve the mechanisms of targeted social protection of the population, including the provision of direct food aid, the implementation of measures to protect against inflation, the development of social contracting practices,

which will increase the real disposable income of the population.

It is important to ensure a reduction in the proportion of the population with incomes below the pro-subsistence minimum. This is impossible without an increase in real incomes of the population, which can be facilitated by a set of measures: the use of a progressive tax scale; introduction of a system of inter-sectoral wage regulation. The optimal level of sufficiency of consumption and economic availability of food for the population can be achieved through joint efforts of the state and business.

Taking into account the identified interrelations, the key areas of agro-food policy in the Volga Federal District should be: stimulating the growth of own production through the use of innovative technologies in meat and dairy cattle breeding; Overcoming the trends in the decline of livestock of cattle and increasing its productivity, developing production technologies, storage, processing, wholesale and retail trade in food, ensuring stable and even consumption for all social groups of the population in volumes that meet scientifically based medical standards.

The implementation of these areas of agricultural and food policy will contribute to the development of the agrarian sector, based on the rational use of existing resource potential. This will make it possible to solve the problem of the stable provision of the population with economically accessible food products of domestic production, raise the standard of living of the population of the country, strengthen the economic and geopolitical position of Russia in the world.

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