Regional aspects of food security

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Abstract. In the present work, we assessed the level of food security in the Chuvash Republic according to the level of physical availability and affordability as well as sufficiency of food products. Adequacy of consumption is determined by comparing the actual volume of product consumption with the rates authorized by the Ministry of Health of the Russian Federation. The analysis revealed a high level of physical availability of food in the region that it is not supported by a sufficient economic basis. As a result, a certain part of the population does not have the opportunity to receive foodstuff in quantity and quality within permissible recommended rates. Solution of the food security problem requires a systematic approach based on the development of agricultural production and solution of the social and economic problems aimed to improve the household quality of life.

1. Introduction
The problem of food security is one of the most important in the modern world economy. It affects the interests of various groups of countries, social and political forces, becoming more and more relevant as world trade and globalization processes develop. At the same time, the issue of food security is becoming more and more controversial and relevant despite numerous studies. Among foreign researchers, we should note B Müller, F Hoffmann, T Heckelei, C Müller, Rahmadanith, S Bulkis, M Arsyad, A Amrullah and Viantika [1, 2] who laid the general theoretical foundations and methodological principles for studying the problem of food security.

Food security in Russia is a major problem that is part of a set of issues that are traditionally considered by national security. According to the rating assessments conducted among countries of the world, the level of food security in the Russian Federation changed little, if at all. So, in 2018, Russia ranked 42nd out of 113 countries (67 points) in terms of food security index and in 2014 it ranked 40th out of 109 countries (63.8 points) [3].

The country received high marks in food quality, affordability, physical availability of food, implementation of national programs on food security and an approachable program for financing of farmers, as well as the availability of food standards. It should be noted that the factor which determines the low index value of the food security in the Russian Federation is the insufficient expenditures on research and development in the field of agriculture (12.5% in 2018).

The country's national food security is totally determined by the ability of the regions to provide domestic food demands. Regional food security assumes that the region produces a certain amount of food for its own needs, and can also acquire food from other regions of the country, foreign countries.

In our opinion, the features of regional food security largely depend on the geographic location of the region, specialization of industry, infrastructure development in agriculture, transportation costs, and food storage costs.
The region’s food security is largely determined by the state of agricultural organizations, the volume and range of exported agricultural and food products, and the development of food markets. There is no doubt that food security must be assessed at the global, international, national and regional levels. In the works of economists agrarians such as: I Ushachev, V Chekalin, M Semikolenova, T Rudakova, N Shavkunova, S A Trofimova, I Trofimova, S P Plotnikova, T V Kiyan and Ermakova I N [4-8], enough attention is paid to the concept and features of ensuring food security in general at the country level and at the regional level.

Nevertheless, the food security of the region is a special economic category that has its own characteristics:
- based on its own agricultural production;
- regional differentiation according to the possibilities of producing environmentally friendly products;
- limited regions to import products due to the income of the population, high costs of transportation and storage of food.

The regional food security has its own suggestions due to natural factors, socio-economic development of the region, geographical location, the state of the regional agro-industrial complex and the food market. In addition to the all-Russian problems there are specific regional features that predetermine the total threat to regional food security. Accordingly, ensuring food security at the regional level should be formed taking into account its location, specialization, infrastructure development, transportation costs and budget constraints. The research objective is to study the regional characteristics of food security under current conditions of accelerated import substitution, considering that regions are an integral element of the country's overall food security, it is quite important to identify specific signs.

The scientific novelty of the study lies in improving the system for assessing the level of food security and developing measures to increase the sustainability of the food system of the regional agro-industrial complex.

2. Materials and methods for study
In order to analyze the level of food security of the Chuvash Republic in our study, we used the complex methodology of D G Olovyanikov, which makes it possible to assess this indicator using four main criteria: physical availability of food, economic accessibility of food, sufficiency of food consumption and its quality (table 1).

| Table 1. Criteria for assessing regional food security. |
|------------------------------------------------------|
| **Criterion**                                      | Level |
|                                                     | High  | Acceptable | Low  | Invalid |
| Food import coverage ratio (Cr)                     | 1.00  | 0.75-0.99  | 0.3-0.75 | below 3.0 |
| Poverty coefficient                                | 0     | 0-0.10     | 0.11-0.20 | high 0.21 |
| Coefficient of purchasing power consumer            | 0-0.07| 0.8-0.20   | 0.21-0.70 | high 0.71 |
| Gini coefficient                                   | 0-0.10| 0.11-0.30  | 0.12-0.50 | high 0.51 |
| Coefficient of sufficiency (energy value)           | high 3050 | 2150-3051 | 1520-2151 | low 1519 |
| Coefficient of dietary patterns                     | high 0 (-15)-0 | -30(-15) | low (-30) |
| Coefficient of food quality assessments             | 0     | 0.01-0.10  | 0.11-0.20 | high 0.21 |

The information base for the calculations was the official data of the territorial body of the Federal State Statistics Service for the Chuvash Republic [9].
IOP Conf. Series: Earth and Environmental Science 604 (2020) 012044   doi:10.1088/1755-1315/604/1/012044

3. Results and discussion

Despite the numerous studies in food security, the common and clear identification was not provided for this definition to this day. Since one of the basic human needs is the need for food, the problem of ensuring food security has stood throughout the history of mankind. However, it received a scientific formulation at the end of the 18th century, after the scientists Condorcet and T. Malthus put forward history and put forward the idea of comparing population and available means of subsistence. To assess food security T Malthus proposed to use the ratio of manufactured products per capita, later this formula formed the basis of economic analysis.

The certain aspects of food security were considered by Russian economists at the beginning of the 20th century and were developed in the works of A Chayanov, N Kondratyev, N Bukharin.

The definition “food security” was first introduced into use in 1974 but it was only identified in 1996 by the Rome Declaration on World Food Security. According to this document, food security means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.

Currently, there are different approaches to defining the concept of "food security" in Russia and abroad. If in the leading Western countries the problem of food security is treated as the need to provide food for the population in the proper quantity and the required quality, then in the Russian Federation food security is understood as food self-sufficiency and import substitution.

In interpreting the concept of food security, Russian economists attach key importance to the issue of the country's dependence on food imports, mainly providing the domestic market with domestic food products.

In accordance with the Food Security Doctrine approved by Decree of the President of the Russian Federation dated January 21, 2020 No. 20, food security means the state of socio-economic development of the country when the food independence in the country is ensured, and physical availability and affordability of food is guaranteed for every citizen [10].

In the framework of this study, the authors understand food security as the ability of the country's population to have economic and physical access to healthy and wholesome food products, mainly of Russian production.

Let's consider the regional features of food security on the example of the Chuvash Republic. At present there are no unified approved developed models that include integrated methods and techniques to assess the food security of the region’s economy. To analyze the state of food security in the Chuvash Republic, we used in our study the technique which allows us to evaluate this index using the criteria: physical availability and affordability of food, sufficiency of food consumption.

The level of food security is assessed according to the criteria of physical accessibility characterizing the constant availability of food throughout the country and at any given time in volumes and assortment that satisfy and correspond to effective demand. The indicators for assessment of physical accessibility of food in the region are presented in table 2.

In 2018 the export of food products and agricultural raw materials in the Chuvash Republic amounted to US$ 23 million compared to US$ 12.4 million, while the export share of food products of agro-industrial complex in the overall structure increased from 4.5% (in 2014) up to 11.8% (in 2018). As part of the national strategy to increase the export of non-raw non-energy goods, the Chuvash Republic should ensure the sale of agricultural products up to US$ 46 million by 2024 [10]. In these conditions, the agrarians of the region are faced with the task of increasing the export of agricultural products by US$ 23 million.

In 2018 the import of food products and agricultural raw materials amounted to US$ 4.3 million, compared to US$ 9.1 million in 2014. It is observed a 52.7% decrease in food import operations that is quite correlated with complex measures for import substitution in agriculture [11].

The level of physical accessibility of food is determined through the import coverage ratio (the ratio of export of food products and raw materials to import of food products and raw materials). During 2014-2018, the import coverage ratio was more than 1 and had a positive dynamic which can be regarded...
as a positive trend in ensuring food security. In general, the level of physical accessibility of food is quite high and the effective demand for food products is fully satisfied in the region.

Table 2. The indicators for assessment of physical accessibility of food in the Chuvash Republic.

| Indicators                              | Years | Rate of change, % |
|-----------------------------------------|-------|-------------------|
| Export of food products and agricultural raw materials, mln. USD | 2014 12.4 | 2015 13.0 | 2016 21.1 | 2017 18.9 | 2018 23.0 | 2017 to 2016 89.6 | 2018 to 2017 121.7 |
| Import of food products and agricultural raw materials, mln. USD | 2014 9.1 | 2015 6.5 | 2016 6.7 | 2017 6.2 | 2018 4.3 | 2017 to 2016 92.5 | 2018 to 2017 69.4 |
| Food import coverage ratio (Cr)       | 2014 1.4 | 2015 2.0 | 2016 3.1 | 2017 3.0 | 2018 5.3 | 2017 to 2016 96.8 | 2018 to 2017 176.7 |
| Level of physical accessibility       | High Cr >1 | High Cr >1 | High Cr >1 | High Cr >1 | High Cr >1 | - | - |

Affordability of food - the level of consumer purchasing power in the existing consumption structure, price system, income level, social securities and benefits which provides the opportunity for the population to purchase basic types of food. The affordability of food is determined using a system of indicators: Gini coefficient, poverty coefficient, coefficient of consumer purchasing power which characterizes the distribution of goods between different social groups at the current income level and food prices. The indicators for assessment of affordability of food in dynamics for 2014-2018 are presented in table 3.

Table 3. The indicators for assessment of affordability of food in the Chuvash Republic.

| Indicators                              | Years | Rate of change, % |
|-----------------------------------------|-------|-------------------|
| Poverty coefficient                     | 2014 0.16 | 2015 0.18 | 2016 0.19 | 2017 0.18 | 2018 0.18 | 2017 to 2016 94.7 | 2018 to 2017 - |
| Low                                     |       |                   |       |       |       |                  |                  |
| Gini coefficient                         | 2014 0.366 | 2015 0.348 | 2016 0.343 | 2017 0.338 | 2018 0.339 | 2017 to 2016 98.5 | 2018 to 2017 100.3 |
| Low                                     |       |                   |       |       |       |                  |                  |
| Coefficient of consumer purchasing power | 2014 0.42 | 2015 0.46 | 2016 0.48 | 2017 0.48 | 2018 0.46 | 2017 to 2016 - | 2018 to 2017 97.18 |
| Low                                     |       |                   |       |       |       |                  |                  |

Analyzing the indicators of food affordability in the Chuvash Republic, it can be noted that 16% of the population in 2014 and 18% in 2018 had an income below the subsistence level and lived below the poverty line.

The consumer purchasing power in 2018 amounted to 46% compared to 42% in 2014 that corresponds to a low group of food affordability. The purchasing power coefficient over the past 5 years decreased by 4% in 2018 compared with 2014.

The problem of food affordability becomes aggravated by a significant differentiation of income between different segments of the population as evidenced by the calculation of the Gini coefficient.
A key indicator which reflects the level of food security in the region is the achievement of sufficient food consumption and daily caloric intake with physiological requirements for energy and nutrients [11].

A set of basic parameters to assess the sufficiency of food consumption is presented in table 4.

**Table 4.** The indicators for assessment of sufficiency of food consumption in the Chuvash Republic.

| Product consumption, kg per year | Years          | Rate         |
|----------------------------------|----------------|-------------|
|                                  | 2014 | 2015 | 2016 | 2017 | 2018 |            |
| grain products                   | 100.8 | 97.4 | 101.6 | 106.1 | 104.3 | 96         |
| potatoes                         | 84.3  | 79.3 | 84.9  | 94.2  | 91.1  | 90         |
| vegetables and cucurbits crop    | 104.5 | 90.5 | 103.1 | 110.3 | 107.1 | 140        |
| fruits and berries               | 90.8  | 68.5 | 71.3  | 79.2  | 80.3  | 100        |
| meat and meat products           | 70.0  | 70.1 | 67.5  | 68.7  | 62.0  | 75         |
| milk and dairy products          | 249.4 | 242.2 | 244.7 | 246.8 | 235.5 | 340        |
| eggs, ps.                        | 198   | 191  | 178   | 208   | 195   | 260        |
| fish and fish products           | 24.6  | 20.9 | 19.5  | 20.7  | 21.1  | 22         |
| sugar and confectionery          | 26.2  | 25.1 | 23.8  | 25.3  | 22.5  | 24         |
| Coefficient of dietary patterns  |       |      |      |      |      | Acceptable level |
| Energy value, kcal per day       | 2568  | 2447 | 2437 | 2581 | 2497 | 2961       |
| Coefficient of sufficiency (energy value) |       |      |      |      |      | Acceptable level |

In 2018, the republic’s households consumed more grain products and potatoes when compared with the actual data recommended by the Ministry of Health of the Russian Federation (order No. 614 of August 19, 2016) [12]. A sufficiently high consumption of grain products in excess of the recommended rational norm is a negative trend and indicates a lack of financial security for households and the need to replace expensive food with cheaper ones.

At the same time, there is an insufficient consumption of vegetables (32.9 kg), fruits (19.7 kg), meat and meat products (13 kg), milk and dairy products (114.5 kg), eggs (65 kg) in relation to the established nutritional standards. In the Chuvash Republic, a deviation from the recommended consumption structure is observed by 19.8% in 2018 and by 17% in 2014. In the Chuvash Republic the excessive consumption of carbohydrates prevails with protein malnutrition according to the assessment of consumption sufficiency.

Such indicator as the person demand in sufficient amount of calories is often used in the world practice. People who are unable to consume a certain amount of calories are considered as the “chronically starving” persons. So in the region, the total energy value of products consumed by the households during the day decreased by 3% in 2018 compared to 2014, but in general it is within acceptable limits.

In accordance with the analysis methodology, the quality of food is assessed using a quality coefficient, which is the proportion of rejected products (meat and meat products, milk and dairy products, fish). The final assessment is based on the average value of the indicators. Assessment of the quality of food products in the Chuvash Republic in the period 2014-2018 indicates a fairly low level. During the period under review, the quality factor did not rise above the “low” level.

Analysis of the level of food security according to the proposed methodology of D G Olovyannikova makes it possible to determine the level of economic, physical accessibility and sufficiency of food, but there are certain disadvantages:

- the impossibility of assessing the sustainability of the food system in the region. The sustainability of the food system is determined by the ability to provide the population with the necessary amount of food of proper quality. In this block, the authors propose to calculate such indicators as: profitability of agricultural organizations, the share of the population employed in agriculture, the volume of food reserves, the share of unprofitable agricultural enterprises;
the block needs to be supplemented to assess the physical availability of products, indicators of the level of development of the food market in the region, the volume of agricultural products per capita;
- a group of indicators of economic affordability, can be expanded in addition to the existing ones, as follows: average cost of a food basket, consumer price index for food: - there is no generalized indicator of the level of food security in the region. For example, the degree of food security in a region can be assessed in accordance with four levels.
1. High: the share of imports does not exceed 10-15%, the region is fully self-sufficient with products of its own production.
2. Acceptable: the region provides itself with products of its own production, along with imports not exceeding 30%.
3. Low: the region provides itself with products of its own production by 31-45%, the rest is accounted for by imports.
4. Unacceptably low: the region is self-sufficient in food, but the share of imports is from 46 to 60%.

4. Conclusion
Thus, the food security in the Chuvash Republic remains unstable despite the presence of favorable trends. The high level of physical accessibility of food in the region is not supported by a sufficient economic basis, due to the inability of a certain part of the population to purchase food at affordable prices. As a result, a part of the households receives food less than due the recommended physical standards. Solution of the appeared problems requires the development of a certain mechanism for ensuring food security in the region aimed at satisfaction of households needs in high-quality and affordable food products. In the long term, the mechanism for ensuring food security in the Chuvash Republic as well as in any other region of the Russian Federation should include:
1. The development of innovative activities in agriculture aimed at the implementation of intensive and resource-saving production technologies, strengthening the breeding in animal production and selection in crop production. In our opinion, it is necessary to stimulate the implementation of environmentally-friendly technologies, the expansion of quality standards for processing enterprises.
2. It is necessary to focus on the following main elements of ensuring food security in the region, such as use of the region’s competitive advantages in agricultural production, expansion of the range of exported agricultural products through measures to support the production and export of agricultural products.
3. Intensification of financial and credit measures to support farmers primarily ensuring the availability of borrowed funds for all categories of goods producers. As examples, we can provide the interest free credits to agricultural producers in exchange for innovative projects and tax benefits to the bank creditors who grant the borrowed funds.
4. The formation of the infrastructure of the agro-food market, the creation of agricultural commodity exchanges and other mechanisms involving an organizational solution to the issue of the sale of agricultural products and food.
5. Socio-economic problems are solved by improving living standards, reducing general social tension, and developing alternative forms of employment. “Rural tourism” can become one of these actions, cooperation of farmers with online stores, the main goal of such stores is to create conditions for the farmer to be comfortable and pleasant to do his own business - to create a delicious, high-quality, environmentally friendly product.

The priority action should be the increase of the economic affordability of food, on the one hand, and the development of agricultural production focused on meeting the needs of the domestic market, on the other hand. The implementation of the priority actions for ensuring food security in the region will allow increasing the level of public confidence in agricultural policy, increasing agricultural production and the availability of high-quality products to the country's population.
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