Situation and trends in food consumption by the population in the region with extreme natural conditions

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Abstract. The paper is devoted to the study of the food provision for the population of the Krasnoyarsk Territory - a region with a continental climate. It gives the estimation of per capita food consumption in the dynamics from 1990 to 2017 compared with rational norms and the minimum food basket of the Krasnoyarsk Territory. Almost all types of foodstuffs increase their actual consumption in recent years as compared with 2000. The energy value of the food ration mainly exceeds the energy content of the ration according to the norms due to the consumption of increased volume of potatoes. The current structure of consumption does not correspond to a rational one: consumption of milk and dairy products, fruits and berries, vegetables and melons and gourds is lower than the recommended norms. In the structure of the diet, the lack of protein is replenished by less valuable protein that comes with potatoes, bakery, cereals and pasta. Such a structure causes an increase in mortality from diseases of the digestive organs and the endocrine system of the regional population. The part of the population (18.5%) of the Krasnoyarsk Territory, which has incomes below the subsistence minimum, has low economic accessibility to food. Taking into account the differentiation of the territory of the region according to the degree of continentality of the climate, the need for foodstuffs for the future is determined for each zone of discomfort. Norms of rational nutrition are developed for the population of the regions of Russia on the basis of their natural and climatic condition characteristics.

Food is important because it satisfies the vital need of the population. Nutrition has a significant impact on human health and activity. Therefore, providing the population with food products is of particular social importance. In addition, nutrition affects the level of labour productivity, and in the structure of monetary expenditures of the population, food takes up a high proportion.

In the system of food supply of Russia, a significant part of the regions is located in territories with extreme natural conditions, which predetermine the structure, volumes and assortment of food for the population. A typical representative of such regions is the Krasnoyarsk Territory. According to [1], the region has a low level of climate comfort, affecting the health of the population and the activity of production activities. Its entire territory is differentiated into four zones of climate discomfort: moderate, strong, very strong and tough. In the zones of very strong and severe climate discomfort, 90.8% of the territory of the region is located and only 2.1% of the territories are located in the zone of moderate discomfort.

Climate discomfort determines the structure of the diet, the total daily energy value and an increased need for proteins and fats.
The level of food consumption is estimated according to scientifically-based standards that take into account the physiological needs of the main groups of the population for energy and nutrients. Rational standards provide the body not only with the appropriate amount of heat, but also with the whole complex of nutrients in a certain combination for normal human activity. A special place among them is occupied by proteins, which are the only tissue-forming substances necessary for the organism, therefore they cannot be replaced by other substances. With their low content in the daily diet, the food is poorly absorbed, the body’s resistance to the effects of infections and other adverse effects is reduced.

According to [2-3], in the Krasnoyarsk Territory in recent years there has been a certain increase in the consumption of certain foods compared to 2000 (table 1).

**Table 1.** Food consumption by the population of the Krasnoyarsk Territory (per year per capita, kg).

| Food products                  | Normal nutritional rate, kg | Food basket for the Krasnoyarsk Territory, kg | Actual consumption, kg | Actual consumption to rational rate, % |
|--------------------------------|-----------------------------|-----------------------------------------------|-------------------------|----------------------------------------|
| Total daily energy value, kcal | 2894.2                      | 2576.3                                        | 3238.7                  | 2711.9                                 |
| Vegetables and gourds          | 140                         | 109.3                                         | 127                     | 108                                   |
| Bakery and pasta in terms of flour | 96                        | 105.3                                         | 116                     | 119                                   |
| Fish and fish products        | 22                          | 19.0                                          | 22                      | 20                                    |
| Sugar and pastry              | 24                          | 22.2                                          | 43                      | 23                                    |
| Vegetable oil                 | 12                          | 9.6                                           | 8.8                     | 8                                     |
| Potatoes                      | 260                         | 203.7                                         | 294                     | 196                                   |
| Fresh fruits and berries      | 100                         | 74.3                                          | -                       | 24                                    |
| Milk and dairy products       | 325                         | 271.5                                         | 386                     | 229                                   |
| Meat and meat products        | 73                          | 52.1                                          | 71                      | 50                                    |

When assessing the actual consumption of food by the population of the region, it should be borne in mind that the data in table 1 do not take into account the actual loss of food in the process of moving from producer to consumer and as a result are overestimated.

In general, the daily energy content of the ration of the average resident of the region has increased in recent years and even exceeded its energy value in terms of rational nutritional standards. The consumption of meat and meat products in 2017 exceeded the recommended rational rate by 9.6%, sugar by 16.7% of potatoes - by 2 times, bread products - by 16.7%. The consumption of milk and dairy products by 28.9%, fish and fish products - by 9.1%, eggs - by 5%, fruits and berries - by 37%, vegetables and melons and gourds - by 28.6% fell below the rational norms.

Protein-containing foods necessary for the conditions of the continental climate of the Krasnoyarsk Territory are compensated by less valuable food products - potatoes, bread, cereal and pasta. Therefore, the actual structure of food consumption does not meet the standards proposed by the Institute of Nutrition (table 2).

**Table 2.** Structure of food consumption.

| Food products               | 2000  | 2005  | 2010  | 2015  | 2016  | Rational structure, % |
|-----------------------------|-------|-------|-------|-------|-------|------------------------|
| Meat and meat products      | 11.6  | 13.0  | 15.3  | 15.8  | 16.3  | 15.9                   |
| Milk and dairy products     | 14.1  | 13.0  | 13.0  | 13.5  | 13.2  | 18.8                   |
| Fish and fish products      | 1.3   | 1.5   | 1.7   | 2.1   | 2.1   | 2.3                    |
| Sugar and pastry            | 8.8   | 8.4   | 9.1   | 9.4   | 9.3   | 8.6                    |
Carbohydrates, pasta and potatoes contain about 50 percent of the food. The consumption of milk, dairy products, fruits and vegetables is lower than the need for these foods.

Despite the fact that the consumption of protein in general corresponds to the norm (table 3), the valuable protein contained in fish, fish products, milk, dairy products, as well as vegetables and fruits is not enough in the structure of the diet.

According to the data of the Krasnoyarsk Agency of Statistics, the structure of the food ration is one of the causes of diseases of the digestive system and the endocrine system; nutritional and metabolic disorders increased from 31.7 in 2013 to 44.5 thousand in 2017 (by 40.4%), with a disease of the digestive organs from 100.5 to 113.5 thousand people (by 12.9%). Mortality due to diseases of the digestive system increased from 69.3 in 2013 to 81.2 people in 2017, that is, by 17.2% per 100 thousand people of the population.

Table 3. Average daily protein intake (2016).

| Food products              | Protein in 1 kg, g | Consumption norm, kg | Including protein, g | Actual consumption, kg | Including protein, g | The actual protein in % to normal |
|----------------------------|--------------------|----------------------|----------------------|------------------------|----------------------|----------------------------------|
| Meat and meat products     | 186                | 73                   | 13578                | 81                     | 15066                | 111.0                            |
| Milk and dairy products    | 32                 | 325                  | 10400                | 247                    | 7904                 | 76.0                             |
| Fish and fish products     | 6.4                | 260                  | 1664                 | 246                    | 1574                 | 95.0                             |
| Sugar and pastry           | 17                 | 22                   | 374                  | 20                     | 340                  | 90.9                             |
| Vegetable oil             | 207                | 12                   | 2484                 | 11.5                   | 2381                 | 95.9                             |
| Eggs (pieces)             | 20                 | 90                   | 1800                 | 185                    | 3700                 | 206.0                            |
| Potatoes                   | 15                 | 140                  | 2100                 | 112                    | 1680                 | 80.0                             |
| Fresh fruits and berries   | 4                  | 100                  | 400                  | 60                     | 240                  | 60.0                             |
| Vegetables and gourds      | 10                 | 96                   | 960                  | 114                    | 1140                 | 119.0                            |
| Total                      | -                  | -                    | 33760                | -                      | 34025                | 100.8                            |

The level of food consumption depends on the affordability of the products. The economic affordability of food in the region is determined by the monetary income of the population (table 4) and food prices.

Table 4. Distribution of total cash income of the population.

| Cash income - total, percent including by 20% population groups: | 2013 | 2014 | 2015 | 2016 | 2017 |
|------------------------------------------------------------------|------|------|------|------|------|
| first (with the lowest income)                                    | 9.7  | 10.2 | 10.4 | 10.4 | 10.6 |
| the second                                                       | 14.8 | 15.1 | 15.4 | 15.3 | 15.5 |
| the third                                                        | 22.5 | 22.7 | 22.7 | 22.7 | 22.8 |
| the fourth                                                       | 47.9 | 46.6 | 45.9 | 46.0 | 45.3 |
| fifth (with the highest income)                                  | 9.4  | 8.6  | 8.2  | 8.2  | 7.8  |
| The ratio of funds (coefficient of income differentiation), in times | 0.423 | 0.408 | 0.398 | 0.400 | 0.391 |

The incomes of the decile group of the most well-being population are almost eight times higher than the incomes of the most low-lived (1:8 ratio). The population with incomes below the subsistence
minimum in 2017 amounted to 531.8 thousand people or 18.5% of the total population. It can be stated that in the Krasnoyarsk Territory this share of the population is in the zone of social instability and cannot satisfy the need for food even in the minimum food basket.

The source of food resources in the region is the production of farms of all categories (table 5).

**Table 5.** Agricultural production in farms of all categories.

| Food products             | Production volumes, thousand tons | 2017 to 2000, % | Per capita, kg | 2017 to 2000, % |
|---------------------------|-----------------------------------|-----------------|----------------|-----------------|
|                           | 2000  | 2010  | 2016  | 2017  | 2000  | 2010  | 2016  | 2017  | 2000  | 2010  | 2016  | 2017  |
| Meat and meat products    | 99.8  | 140.5 | 209.2 | 224.0 | 227.5 | 33.0   | 49.7   | 50.5  | 78.2  | 108.1 |
| Milk and dairy products   | 731.0 | 707.4 | 733.5 | 749.4 | 102.5 | 241.9  | 250.1  | 255.9 | 261.5 | 113.8 |
| Fish and fish products    | 736.9 | 774.4 | 790.5 | 795.6 | 108.0 | 243.9  | 273.8  | 275.8 | 277.6 | 116.0 |
| Sugar and pastry          | 1747.5| 2070.9| 2353.5| 1921.7| 110.0 | 578.2  | 732.2  | 821.2 | 670.5 | 121.3 |
| Vegetable oil             | 957.9 | 1253.8| 1253.3| 1101.8| 115.0 | 317.0  | 443.3  | 437.7 | 384.5 | 103.0 |
| Eggs (pieces)             | 243.9 | 272.3 | 236.5 | 238.1 | 97.6  | 80.7   | 96.3   | 83.3  | 83.1  | 103.0 |

Due to the growth in agricultural production, in addition to vegetables and melons, their production per capita is also increasing. Production of meat and vegetables per capita does not provide their actual per capita consumption. The lack of these products is covered by imports from abroad and other regions of Russia.

Taking into consideration the continental climate of the Krasnoyarsk Territory, the diet of its inhabitants should contain the required amount of protein-containing foods. Therefore, in determining the need for food for the population of each zone of the region, with different climate discomfort, the energy value of the diet should be differentiated: for the zone of hard and very strong discomfort - 3500-4000 kcal, for the zone of severe discomfort - 3200-3500 kcal, for the zone of moderate discomfort - 3000-3200 kcal [4]. But it is necessary to observe the ratio of the main components of food (an increase in proteins, fats, with some decrease in carbohydrates in the diet).

The revealed features of the climatic conditions of the Krasnoyarsk Territory must be taken into account when solving the problem of food supply of its population for the future. And for each region of Russia, it is necessary to develop an appropriate structure of the diet, taking into account the peculiarities of their natural and climatic conditions, since in the present period rational nutritional standards have been established for the country as a whole.

**References**

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