The problem of food safety in modern conditions

I Yu Tarmaeva¹³, O G Bogdanova²⁴ and E A Tkachuk²

¹ Federal Research Center for Nutrition, Biotechnology and Food Safety, 2/14, Ustinsky passage, Moscow, 109240, Russia
² East-Siberian Institute of Medical and Ecological Research, building 3а, 12A microdistrict, Angarsk, 665826, Russia
³ Peoples’ Friendship University of Russia, 6, Miklukho-Maklaya str., Moscow, 117198, Russia
⁴ East Siberian State University of Technology and Management, 40B, Kljuchevskaja st., build. 1, Ulan-Ude, 660013, Russia

E-mail: olga.bogdanova2001@gmail.com

Abstract. The proportion of local food in the Republic of Buryatia according to the criteria of a minimum permissible self-sufficiency rate (lim) approved by the Doctrine indicates that the Republic provides only 46.1% of local meat and meat products production for its needs (in the Russian Federation it is 74.6% with the required level of 85%). There is an increase in the share of imported meat and meat products from 30.1% to 57.5%. As for the potato availability it is fully satisfied, and over-indexes the consumption level of 74% (in the Russian Federation it is 2%). During the analyzed period the eggs and egg products production in the Republic was increased by 11%, the volume of imported products was increased by 1.7 times, self-sufficiency rate is 33.1%. There is a low self-sufficiency rate of fruits and berries – 10.6% and in the Russian Federation – 33%. The volume of imported vegetable products increased by 2.5 times mainly due to the imported products. The self-sufficiency rate of in the Republic of Buryatia was 70.8%, in Russia it is 80.5%. For the food safety integrated assessment of the Republic of Buryatia a normalized indicator was calculated. It takes into account the local products hurdles in the commodity total volume for the food main types that is 49.9%. The food safety in the Republic of Buryatia is estimated as low due to the total absence of some producing: vegoil, sugar, meat, fish, fruits and vegetables.

1. Introduction

The environment quality and safety to a great extent determine the public health level and have direct causal relationships with adverse changes in a human body. Failure to comply with the principles of a healthy diet can cause the development of various noncommunicable diseases including the most common ones such as obesity, diabetes, vascular and heart diseases, as well as cancer [1, 2]. As many authors have noted the environment sedentary pollutants are intaken into the human body from 70 to 100% from the chemical and biological food contaminants [1, 3–6].

The current globalization of the consumer market implies that the problems of improving the quality of food products and improving the food safety system of the country are becoming widespread. The main reason for it is the followling: the global market is characterized by an extended supply chain (from raw materials to final products), the responsibility and reliability of suppliers in the chain, as well as competitiveness, concentration of capital and the possibility of increased investment
in product quality measures [4, 5] The food and processing industry of the Republic of Buryatia is one of the strategically important sectors that determine the provision of food to the population, and includes 11 industries related to the agricultural raw materials processing and the food and beverages production for the population [7].

The leading industries are meat, dairy, baking, confectionery, fruit and vegetable, liquor, etc. There are about 400 enterprises of ownership various forms in total employing nearly five thousand people. The experience of experts in the field of HASSP showed that in the Republic of Buryatia, as well as in the Russian Federation, voluntary certification GOST R ISO 22000-2007 "Food safety management systems.

Requirements for organizations participating in the food chain” is carried out mainly by branches and representative offices of the international organizations, federal network companies engaged in activities in the field of food and processing industry. In turn, the domestic producers of the HASSP system are represented to a greater extent as a cost, rather than an investment in the products quality and safety as well as a factor that forms a reputation in the eyes of suppliers and consumers [8–10].

2. Results and Discussion

Over the past few years the trade turnover of products manufactured by the enterprises has been steadily growing. The value of shipped own production goods in a full range of the food and processing industry enterprises in the average for the period 2010-2017 amounted to 8017.313 million rubles in prices valid for 2017 (for net economic activities) which is 2.48 times higher than the average for the period 2002-2009 which was 3235.175 million rubles (figure 1).

According to the food safety Doctrine to assess the state of food safety as a criterion is determined by the proportion of domestic agricultural, fish and food products in the total volume of commodity resources (including rolling stocks) of the domestic market of relevant products that has thresholds (table 1).

Analysis of the data on the proportion of local food in the Republic of Buryatia according to the criteria of the minimum permissible level of self-sufficiency in various types of food (lim), approved by the food safety Doctrine, approved by the decree of the President of the Russian Federation on 30.01.2010 № 120, indicates that the meat and meat products of the Republic of Buryatia provide its needs only for 46.1% of local production (in the Russian Federation – 74.6 %, with the required level of 85 %). There is an increase in the share of imported meat and meat products from 30.1 % of the level of resources in 2002 to 57.5 % – in 2017 (produced – 28.7 thousand tons, imported – 38.9 thousand tons).

It should be noted that a more favorable situation is observed for milk and dairy products. Thus, during the analyzed period the volume of dairy products imported into the territory of the Republic during this period increased 4.1 times (from 23.2 to 95.4 thousand tons) and ranged from 12 to 42 %, respectively of the annual volumes produced in the Republic.

![Figure 1. Dynamics of the volume of shipped goods of own production in the sectors of food and processing industry of the Republic of Buryatia (according to Buryatstat, mln. rub).](image-url)
Table 1. Share of local food in total commodity resources for assessing the state of food safety of the Republic of Buryatia, %.

| Product                     | Threshold value\(^a\) | Share of domestic products on average in Russian Federation for the 2010–2017 \(^b\) | Share of local products on average in Republic of Buryatia for the 2010–2017 \(^b\) |
|-----------------------------|------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Sugar                       | At least 80            | 95.75                                                                                        | –                                                                                           |
| Vegetable oil               | At least 80            | 78.1                                                                                         | –                                                                                           |
| Meat and meat products      | At least 85            | 74.6                                                                                         | 46.1                                                                                        |
| Milk and milk products      | At least 90            | 81.5                                                                                         | 89.2                                                                                        |
| Fish products               | At least 80            | 80.65                                                                                        | 10.2                                                                                        |
| Potato                      | At least 95            | 98.7                                                                                         | 174.5                                                                                       |
| Salt                        | At least 85            | –                                                                                             | –                                                                                           |

\(^a\) Established by the Doctrine of food safety, approved by the Decree of the President of the Russian Federation on 30.01.2010 №120.
\(^b\) the data of the Federal State Statistics Service.
\(^c\) the data of the Buryatstat.

The Republic of Buryatia supplies itself by potato fully. The resource provision of the population of the Republic with potatoes during the researched period has not undergone the significant changes. The production for a number of years (2002–2017) has been remained at the level of 170-167.7 thousand tons per year. Moreover, the potato production was 74 % higher than consumption (2% in Russia).

During the analyzed period the production of eggs and egg products in the Republic has increased for 11 % and amounted up to 65.0 million units in 2017 against 58.4 million units in 2002. During the same period the volume of imported products has increased 1.7 times – from 87.3 million units in 2002 to 150.0 million units in 2017. The number of imported products exceeds the volume produced in the country for 2.3 times. The total resource has increased 1.6 times, from 146.9 million units in 2002 to 235.1 million units in 2017. The level of self-sufficiency amounted to 33.1 %.

The Republic of Buryatia has a fairly low level of self-sufficiency in fruits and berries as in other regions of the Siberian Federal district. Thus, during the period of 2002-2017 the production of fruits and berries in the Republic has decreased (2002 – 6.9 thousand tons, 2017 – 3.5 thousand tons). In the observed period it is shown the growth of imports of 2.2 times, from 15.3 million tons in 2002 to 33.7 million tons in 2017. The level of self-sufficiency in the Republic of Buryatia is 10.6 %, in Russia – 33 %.

There was an unfavorable trend in self-sufficiency in vegetable products in the Republic during the period 2002-2017. Along with the decline in vegetable production (2002 – 79.1 thousand tons, 2017 – 52.8 thousand tons), during this period there was an increase in the volume of imported vegetable products 2.5 times – from 8.6 thousand tons in 2002 to 21.7 thousand tons in 2017 (11 % and 41 %, respectively, of production). The level of self-sufficiency in the Republic of Buryatia was 70.8 %, in Russia – 80.5 %.

For a comprehensive assessment of the food safety of the Republic of Buryatia, a normalized indicator [2] was calculated, taking into account the threshold values of local products in the total volume of commodity resources.
The conducted hygienic assessment of chemical and microbial contamination of food raw materials and food products for the period of 2002-2017 showed that for certain groups of food products of domestic and imported production there was an unfavorable situation, over the past 8 years there was an increase in the average index of chemical contamination compared to 2002-2009, including groups "poultry and poultry products", "fish, fish products and other hydrobioms", "bakery and confectionery products", "potatoes" and others. Among the 9 groups of imported food products in 5 there is an increase in the share of samples that do not meet the hygienic requirements for sanitary and chemical indicators ("poultry and poultry products" – 6.0 times, "fish, fish products" – 1.2 times, "melons" – up to 2.22 ± 0.71 against the absence of inappropriate samples, "vegetables" – 1.2 times, including "potatoes" - 3.2 times, "other" – 3.6 times). Deterioration in meat poultry and fish products is due to the tightening of requirements and the introduction of a rate regulating mass of moisture removed when defrosting poultry, the weight of glaze deposited on fish products.

For imported fruits and vegetables, concentrations of cadmium (2.8 times), arsenic (1.5 times) and nitrates (1.26 times) exceeded the permissible level. Laboratory researches have shown that nitrates remain the most massive pollutants for a number of years. On technogenic pollution by radionuclides there is no excess of hygienic standards, indicators of parasitic purity in food raw materials and food products are not significant.

When carrying out cluster analysis in the dataset on the proportion of non-standard samples on sanitary-chemical indicators identified 4 groups, including the third cluster made up of 5 districts. They are Selenginsky, Mukhorshibirsky, Zakamasinsky, Yeravninsky and Pribaykalsky districts and Ulan-Ude, which consistently recorded the highest proportion of samples that do not meet hygienic requirements (share of sources (SS) [15-29]%). The fourth cluster – 6 districts, (Severo-Baykalsky, Kabansky, Tunkinsky, Dzhidinsky, Khorinsky and Kizhinginsky), in which non-compliant samples were detected very rarely (SS [0.5–2.2]%).

The analysis of microbiological safety allowed one to determine that when comparing the average values for the periods from 2002-2009 and 2010-2017 for two groups of food products, there was an increase in the specific weight of non-standard samples, including bakery and confectionery products – 3.3 times (from 1.8 ± 0.0 to 5.93 ± 0.32 %), fatty plant products – 2.6 times (from 2.37 ± 0.26 to 6.16 ± 0.72 %, respectively). In addition, the share of NS imported food products in the group "total" increased 2.7 times (from 2.9 ± 0.33 to 7.7 ± 0.16 %), for the first time in the last 5 years, nonconforming samples for the group "meat and meat products" – 4.34 ± 0.45 %.

The analysis of microbiological contamination on the territorial basis revealed high levels of inappropriate food samples. The first cluster covers the following areas: Yeravninsky, Pribaykalsky, Kizhinginsky, Kabansky and Ulan-Ude (SS [5.1–7.8] %), the lowest – in the third cluster: Muisky, Barguzinsky, Kurumkansky, Okinsky, Bauntovsky (SS [0.10–0.24]%).

3. Conclusion

Thus, food safety in the Republic of Buryatia is estimated as low due to the complete lack of own production: vegetable oil, sugar and the lack of production of meat and fish products.

Along with low self-sufficiency in the Republic of Buryatia, there is a low level of production of enriched food products necessary for the prevention of micronutrient deficiency. The share of enterprises producing fortified products in 2017 amounted to 7.2 % of the total number of food enterprises of the Republic, which is 1.6 times lower than the average Federal level (11.6% in Russia). At the same time for the analyzed period there is a positive dynamics of growth of the share of enterprises with the production of enriched products by 6.7 % (2002 – 0.5 %). In general, the production of food products enriched with essential nutrients and bifidobacteria is carried out at 30 food processing enterprises of the Republic.
The largest share of enterprises producing fortified foods is observed in the baking industry. Thus, there are only 160 baking enterprises in the Republic, while bread products for therapeutic and preventive purposes are produced at 26 bakeries which is 16.25 % of the total number of operating bakeries. Compared to 2002, there were some positive developments in 2017. The number of enterprises that have mastered the production of enriched bread increased by 13 times (in 2002 – 2 enterprises). Range of enriched bread products has expanded 3.5 times and amounted to 14 items versus 4 in 2002, however, the volume of produced enriched products is insufficient to meet the needs of the population. According to the Ministry of Agriculture and Food of the Republic of Buryatia, the volume of enriched bread products was 1666.5 tons, which is 5.2 % of the total volume of grain products. Consequently, in the Republic of Buryatia the ratio of local food products imported from other subjects of the Russian Federation and imported from abroad is not optimal. The current unfavorable situation in terms of self-sufficiency of the Republic of Buryatia is observed in meat and meat products, eggs and egg products, vegetables, melons, fruits and berries. Thus, 53.9 % of the annual level of meat consumption, 89.4 % of fruits and berries, 29.2 % of vegetables are imported to the Republic from other regions of Russia, as well as from abroad. In addition, the share of imported meat and meat products increased 1.9 times, milk and dairy products – 4.1 times, eggs of food chicken – 1.7 times.

Strengthening the monitoring of the quality and safety of food products is very appropriate in terms of preventing the penetration of low-quality and potentially dangerous food products into the regional market [5, 7, 10]. At the same time, the paradigms of the legislation of the Russian Federation on technical regulation, acting at the present stage, interpret the need to develop a strategy for the management of food safety factors for public health, based on the principles of HASSP, as well as determining priorities for the study of contaminants and optimization of laboratory tests.

References
[1] Tutel'jan V A, Gorohov A V, Mihajlova E I, Vladimirov L N et al 2015 Policy of healthy nutrition of the population of the Republic of Sakha (Yakutia) Jakut medical journal 51(3) 6-9
[2] Tarmaeva I Yu, Efimova N V, Khankhareyev S S and Bogdanova O G 2018 Features of the actual nutrition of the adult population of the Republic of Buryatia in modern conditions Nutrition issues 87(5) 30-35
[3] Hotimchenko S A, Bessonov V V, Bagryantseva O V and Gmoshinsky I V 2015 Safety of food products: new problems and ways of decisions Occupational health and human ecology 4 7-12
[4] Popova A Yu, Zaytseva N V, Mai I V and Schur P Z 2015 To a problem of the choice of priorities at the organization risk - the focused supervision of safety of the consumer products turned on a common economic space of Russia, Republic of Belarus and the Republic of Kazakhstan Health Risk Analysis 11(3) 4-12
[5] Turchaninov D V, Vi'il'ms E A, Glagoleva O N, Kozubenko O V et al 2015 Approaches to evaluation and leading the direction of preventing the negative effects of a complex of nutritional factors and lifestyle on health Hygiene and sanitation 6 15-20
[6] Xie Z, Lin H, Fang R, Shen W et al 1989 Effects of a fruit-vegetable dietary pattern on oxidative stress and genetic damage in coke oven workers: a cross-sectional study Environmental Health 14 DOI: 10.1186/s12940-015-0028-5
[7] Tarmaeva I Yu, Efimova N V, Vasilovsky A M and Bogdanova O G 2014 Food security and the health of the population of Eastern Siberia p 140
[8] Istomin A V and Litvinova O S 2015 Modern questions of hygienic safety and quality of food of the population Population Health and Life Environment 264(3) 18-22
[9] Popova A Yu, Trukhina G M and Mikhailova O M 2016 Implementation of the principles of HASSP at the enterprise of production of onboard food Hygiene and sanitation 11 1083-1085
[10] Perekusikhin M V and Vasilyev V V 2015 Assessment of quality and safety of food staples and foodstuff, population food in the system of social and hygienic monitoring and ensuring health Occupational health and human ecology 4 264-269