Quality and Competitiveness Assurance Methodology Development for Enriched and Specialized Foods

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Abstract. In this article, we deal with theoretical and methodological aspects of assessing and ensuring the quality and competitiveness of enriched and specialized food products. We marked the necessity of development and introduction of scientifically based methodology and information support of analysis, evaluation and forecasting of competitiveness of commodity producers and separate kinds of products, considering dynamic development of technologies and innovations on the market of enriched and specialized products, work on improvement of properties of products and rational satisfaction of consumer preferences. Specialty products are considered as a special group of products for healthy and rational nutrition of the population. We present the new developments of the specialists of the Republican Unitary Enterprise “Scientific-Practical Center for Foodstuffs of the National Academy of Sciences of Belarus” in the field of healthy nutrition.

1. Introduction

In the food market of the Eurasian Economic Union, CIS and other regions Belarusian products demonstrate consistently high quality and safety indicators. Market success is ensured by continuous improvement of quality management at supranational, national and local levels (agribusiness associations, raw material and ingredient producers, etc.). At the same time, competition in the food market is constantly increasing, which sets new urgent tasks for producers and sectoral authorities to improve the competitiveness of domestic products and ensure the fullest realization of their export potential [1–5].

The category “product quality” is inextricably linked to the concepts of competition and competitiveness. Competition in the market of goods and services forces producers to continuously improve their production and increase their innovation potential [6, 7, 8]. Competitiveness characterizes the set of consumer properties of products, necessary and sufficient for them to be sold at socially acceptable prices in a particular market at a certain point in time [2, 9]. In the conditions of stable market saturation with food products for different population groups (differentiated and specialized by health status, age, commitment to a healthy lifestyle, etc.) the struggle for consumer preferences is constantly increasing, the role of non-price forms of competition, including competition in quality, is increasing more and more.

At present, commodity producers have the opportunity to use modern world experience in the field of product quality management, including the concepts of international standards ISO 9000 and 22000.
series, statistical methods, quality control tools, quality function deployment methodology QFD, “Six Sigma” approach, and domestic experience, such as qualimetric forecasting and qualimetric evaluation methodology [6]. According to the international standard ISO 9000:2015 “Quality Management Systems – Fundamentals and Glossary”, the quality of an organization's products and services is defined by the ability to satisfy customers and the expected or unintended impact on other stakeholders. The quality of products and services encompasses not only their inherent functions and parameters, but also the perception of their value and usefulness by the consumer.

The processes are fundamentally based on the principles of the "quality triad", according to which quality is managed through three processes: quality planning (it is necessary to plan and design the quality of products and processes that meet the established requirements during the development phase); quality control (it is necessary to carry out the control to determine the necessity of carrying out and the object of process correction practically at all stages); quality improvement (implies the implementation of activities to identify the best ways to improve processes) [10].

According to the modern concept of quality management and international ISO standards, in particular ISO 9004–1–94 “Quality management and quality system elements. Part I. Guidelines”, the main task of the enterprise is to ensure high quality of products. At the same time, the successful operation of the enterprise is ensured by the production of goods that: meet a clearly defined need, application or purpose; satisfy the requirements of the consumer; meet the applicable standards; meet the requirements of society; are offered to the consumer at competitive prices.

Directed quality improvement of products is based on the following: practical application of results of recent and publicly known scientific research in the field of healthy nutrition (e.g., after the discovery and dissemination in the media of the benefits of antioxidants, the customer wants to see products with antioxidants); analysis of changes in consumers' eating habits; taking into account the increasing role of additional guarantees of product quality and safety required by consumers and government authorities.

Starting from 2020, the Republic of Belarus has the “Quality 2021–2025” Programme, which provides for the implementation of a set of major directions [11]:

– development of technical regulation tools, including the creation of infrastructure for compliance assessment (testing laboratories, certification bodies); participation in the implementation of the initiative on digital transformation of the EAEU technical regulation sphere;
– planning and development of interstate standards and state standards based on advanced international and regional criteria in specific sectors of the economy;
– development of sectoral competencies and consulting in the field of quality infrastructure and effective management;
– motivating, stimulating and promoting ideas of quality and business excellence, including the establishment and evaluation of product quality targets and indicators; introduction of effective systems of work incentives, as well as risk assessment for effective achievement of business goals of organizations and projects and other measures.

One of the priorities of the national socio-economic and food policy is to improve the nutrition and health of the population. Nutrition is a significant tool to influence public health, the development of diseases of infectious and non-infectious nature, increasing the duration and extension of pain-free life, the preservation of physical and mental health. Unbalanced or excessive intake of certain micronutrients is often the cause of various pathological conditions. This leads to a decrease in the overall resistance of the body, a significant increase in infectious and noninfectious diseases. This trend determines the need for food products with additional functions and properties [12]. The priority tasks of state policy in the field of healthy nutrition today are to increase the production and expand the range of food products enriched with functional ingredients, specialized foods, products of functional purposes, including food for organized groups, and biologically active additives to food. Expanding the range of these products is one of the main components of a healthy diet [3, 5].

At present, a variety of methods of correction of human diet are applied. One of the most widespread methods today is food enrichment by adding special ingredients in the form of biologically active components. The formation of functional properties of new types of food products can be implemented
using the principle of food combinatorics, i.e. taking into account the quantitative selection of the introduced components of raw materials and additives in order to ensure the composition of the finished product. This method of correction is promising, providing safety and the highest assimilability of introduced microelements and allows to obtain products of functional purpose with predetermined properties [13].

In the fight against diseases and disorders caused by malnutrition, the World Health Organization and the Global Alliance for Improved Nutrition (GAIN) are implementing programs in different countries to develop new foods with defined characteristics, including enriched foods. In order to maintain and improve the nutritional value of food products and to meet the specific needs of certain population groups, public authorities are implementing policies aimed at adding essential nutrients to food products.

The concept of innovative modeling strategy of food products with the given properties includes the search for new resources of micronutrients, the use of unconventional raw materials, the creation of new technologies that increase the nutritional and biological value of the product, give it the needed properties and increase its shelf life.

The production of enriched and specialized food products is a promising trend in the food industry. The main purpose of this product category is to improve digestive functions and cardiovascular system, enhance nonspecific resistance to environmental factors and increase energy metabolism of the human body. When developing food products, the priority quality indicators are organoleptic qualities of the product (attractive taste and aroma), nutritional value and safety [3, 14]. According to the World Health Organization, a balanced diet plays a key role in the prevention of cardiovascular diseases and a number of cancers, obesity and diabetes mellitus, immunodeficiency conditions, bone system pathology [15].

The results of studying the actual diet in different regions of the Republic of Belarus show that when there is sufficient energy intake with the diet, there is an imbalance and shortage of a number of essential nutrients (lack of selenium, calcium, vitamin C and other essential nutrients). There is a need to substantiate regional norms of nutritional status assessment indicators, as well as to expand the use of data on the chemical composition and energy value of domestic food products.

At present a significant part of the population in Belarus needs health improvement through high quality nutrition. The creation of new types of food enriched with biologically active substances that are able to adjust the metabolic processes in the human body, enhance its defense mechanisms, reduce the risk of alimentary-dependent diseases plays a special role in the implementation of policy in the field of healthy nutrition.

One of the main directions in solving the problems aimed at providing nutritious food for the population is the satisfaction of the physiological needs of people in basic foodstuffs and essential nutrients. It justifies creation of promising technologies for the development of new types of food products as a system of actions aimed at meeting the needs of the population in high-quality and affordable food.

The development of consumer-oriented food products allows a person to purposefully block undesirable processes in the body during their daily use and, on the contrary, develop and protect physiological processes that increase the level of health and efficiency.

When developing new products and improving existing products, customer evaluation of product quality is essential. Despite the fact that it may differ from the organoleptic characteristics determined by a professional tasting panel, it is it that plays an important role in the promotion and sales of products in highly competitive conditions.

The analysis of existing theoretical and methodological approaches [9, 16, 17, 18] allowed us to identify the following elements of the system of forming the quality of products with specified consumer characteristics (figure 1).
### Figure 1. A model of a product quality system with improved consumer performance.

The creation of targeted, individually tailored performance foods offers new growth opportunities for the food industry, which in the future will require the specific efforts of different stakeholder groups (scientists, technologists, food ingredient suppliers, food companies, marketers). Today, multinational food companies as well as food ingredient suppliers operating internationally are in the best position to overcome specific challenges in developing and marketing foods with specific characteristics [19].

Categories of functional foods vary by country, including: Codex Alimentarius (European Union): Labelling and Information Acts (1990), Food supplements for health and consumer information (1994) (USA); the Special Health Food Acts (1991) and the Producers' Association (Japan); common standards for functional foods (China) [5].

The Republic of Belarus has the Doctrine of National Food Security of the Republic of Belarus until 2030, which defines a strategy for sustainable food supply to the population until 2030 for a full diet and a healthy lifestyle through the development of competitive agricultural production, as well as the creation of socio-economic conditions to maintain the consumption of basic foodstuffs at a rational level.
According to the Doctrine, the quality of nutrition characterizes the adequacy and balance of a person's diet in terms of the content of essential nutrients and micro- and macronutrients, as well as the appropriate culture of consumption at household level. Healthy nutrition is defined as scientifically substantiated nutrition provided with a range of safe food products with sufficient nutrients, macro- and microelements in an optimum ratio depending on gender, age, state of health, nature of activity, providing the optimal life quality [20].

Similarly, the concept of healthy nutrition is established in the Concept of the State Policy in the Field of Healthy Nutrition of the Population of the Republic of Belarus: healthy nutrition - scientifically proven adequate nutrition that contributes to optimal life activity of the human body depending on gender, age, health status, nature of activity, contributing to the prevention and treatment of diseases, provided with sufficient macro- and micronutrients and a range of safe food products. The issues of improving the quality of products in Belarus are given constant attention at the state level, it is now extremely important and necessary, and requires constant improvement of systems for assessing the quality of food products. This issue is especially relevant when conducting voluntary certification, when there are many public and private institutes, laboratories, testing centers that conduct various studies of the quality of goods and issue their own certificates. The Scientific and Practical Centre for Food of the National Academy of Sciences of Belarus is an organization within the system of the National Academy of Sciences of Belarus, which is responsible for controlling the quality and safety of food products. The following examples can be given as individual innovative product developments in the special area.

On the basis of the experimental and technological section of the Food Center, a workshop for the production of baby food products was created as part of the implementation of the State Program for the Development of Agricultural Business for the first time in the Republic of Belarus, 11 kinds of low-protein food products for patients with phenylketonuria were developed: low-protein pasta, low-protein dry mixes for the preparation of mashed potatoes, dumplings, muffins and cookies, low-protein porridge and cereals, cookies, small bakery products; and their production is organized (figure 2).

![Figure 2. Dry low-protein foods for the nutrition of patients with phenylketonuria.](image-url)
The developments are innovative, import-substituting in nature and have significant export potential for the EAEU market, as well as expanding the diet for children, including those with phenylketonuria. Creating new products for children with phenylalanine hydroxylase deficiency contributes to the efficiency and competitiveness of national producers of baby food based on safe and quality raw materials and reduces the financial cost of feeding sick children.

For the first time, a technology has been developed for the production of fruit and vegetable-based baby food in soft pouch-type packaging, characterized by significant barrier properties and a high degree of protection, which ensures the preservation of vitamins (figure 3).

Based on the monitoring of the actual provision of children and adolescents in the Republic of Belarus with vitamins and minerals, the most pronounced deficit of vitamins B1, B2, PP, A, and minerals – calcium and phosphorus has been noted, and new types of confectionery products have been developed and introduced.

The nutrient composition of biscuits for preschool and school-age children with increased nutritional value due to the use of domestic raw materials (oat, wheat, barley and rye flakes, carrot, apple and pumpkin puree) is optimized according to the age physiological needs of preschool and school-age children, and the product itself has a high export potential (figure 4).

Chocolate products, chewable marmalade for children using vitamin and vitamin-mineral premixes have been developed, and the production technology has been mastered. Vitamins and minerals added to the marmalade contribute to the normal functioning of the immune and nervous system, support normal vision, bone, skin and mucous membranes, provide iron absorption and normal energy metabolism in the body (figure 4).
2. Conclusion
Based on the research conducted, it is reasonable to make the following suggestions. It is established that nutrition plays the leading role in an individual way of life and with proper organization of nutrition it is possible to reduce general sickness rate considerably, to increase organism's resistance to adverse factors of external environment and to increase life expectancy. This demonstrates the importance and necessity of providing the population with food of high quality and specified composition (enriched, specialized) in accordance with the needs of different population groups.

Improving the quality of life of the population, reducing the number of nutritional diseases and, consequently, increasing life expectancy is only possible by forming a stereotype among the population about the need for a rational diet. This process takes a long time, so the government's task today is to
encourage producers to create food products with added value, whose consumer properties would guarantee their mass character and popularity among the population.

It is obvious that the quality of food products, their compliance with the requirements of regulatory and technological documentation along with the cost are the main factors determining their competitiveness. In this case, product quality and compliance with established requirements are the objects of purposeful influence for the processes of production process management. This indicates the need to develop a comprehensive system for assessing the quality and competitiveness of food products based on the development and implementation of science-based methodology of analysis, evaluation and prediction of competitiveness of producers and individual products, taking into account the dynamic development of technology, product properties and consumer preferences.

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