Quality management of the enriched flour confectionery with application of the qualimetric analysis

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Abstract. The article analyzes the improvement of the quality of enriched cookies to meet the expectations of consumers. This paper shows the application of QFD methodology for a new type of enriched flour confectionery. The analysis allowed to determine the relationship between consumer expectations and technical characteristics of the new product, to prioritize physical and chemical indicators that determine the functional orientation of the product, to identify the most important criteria for consumers. The matrix of consumer requirements, which allows to predict the improvement of the quality of the new product. The results allowed to determine the direction of improving the quality of enriched cookies, to form a range of consumer properties. The results were tested in the production conditions of the enterprise of the Kemerovo region.

1. Introduction
Currently, ensuring the quality of food products is an urgent and main task identified by a number of government and regional programs. The focus is on the importance of continuous monitoring of customer satisfaction [1].

Peter the Great St. Petersburg Polytechnic University has developed a methodology in which the assessment of customer satisfaction implies the degree of discrepancy between the perception of the product and the expectations of the consumer, the order of the method [2].

Criteria, procedures, and modern methods of assessing customer satisfaction are described [3-9].

It is noted that the quality of services is an important issue, in this regard, the introduction of quality management systems and the use of statistical methods of control for evaluation is of great importance in the management of the organization to improve its activities [10-14].

The Cano method has also found wide practical application in assessing customer satisfaction and identifying product attributes that need improvement. Since customer satisfaction is proportionately related to perceived importance (cost) of consumption, adequate attention should be paid to satisfying the requirements (functions) of the user from design to final implementation of the project. The inclusion of user requirements in the design of the product at the stage of its development is of great value for future consumers [15 - 19].

In this connection, it is particularly important to assess customer satisfaction with the new product, which is planned to bring to the consumer market.

The Kuzbass region is characterized by a shortage of vitamins, macro and micronutrients in the diet of the population. An important advantage of this group of food products is the ability to simulate the
formulation and range. In this case, a significant role is given to consideration of all aspects, including the study of consumer characteristics of new products taking into account the expectations of consumers [20-22].

Since the competitiveness of products is a key indicator in assessing the competitiveness of the enterprise, when deciding on the production of a new product, it is necessary to take into account all the properties of the product, including those characterizing consumer values [23, 24].

Review of publications. The effectiveness of the use of biologically active food products in the diet for the prevention of alimentary diseases has been proved by a large number of clinical trials [25-31]. M. Hettiarachchi considers the advantages and disadvantages of food fortification, however, notes that enriched food reduces the risk of many diseases, promotes the development of children in need of constant consumption of trace elements for growth and development [32]. Studies conducted by Troesch B., Hoeft B and other European scientists have found that the consumption of fortified foods developed by manufacturers of recommended standards is common in Western countries [33-34]. S. Aral believes that the prevention of diseases such as diabetes, atherosclerosis, osteoporosis, allergies, cancer, and even some types of infectious diseases can be solved by improving the diet in everyday life, namely through functional products and products for specialized purposes [35].

However, despite the achievements in the field of product enrichment and improvement of the food distribution system, it is necessary to continue research aimed at the development of healthy food products and their promotion [36-37].

To encourage consumers to purchase fortified foods, especially low-income consumers, it is necessary to change their attitude to these products, according to Lisa Mancino, Joan Guthrie, etc. When studying ways to stimulate "healthy shopping", the authors considered the General attitude of consumers (the total sample was 1263 adult respondents) to fortified foods and their intentions to purchase. It is shown that the direct effect can be mediated by the tangible personal benefit of the acquisition of enriched food, and the indirect effect by the awareness of the problem and the perceived expediency of food enrichment. The results of the analysis confirmed that the General attitude to food enrichment is associated with perceived personal benefits, especially in conditions of high awareness of the problem [38].

At the same time, American scientists expressed concerns about the excessive use of enriched products by some consumers. It is noted that access to fortified foods is increasing, so it is increasingly important to monitor the risk of over-consumption of nutrients [39].

Arkhipov and Z A Baranova believe that the main reasons for the low demand for preventive products in Russia from the point of view of consumers are: ignorance of the population about the medicinal properties of products, high prices, insufficient choice and poor quality [40].

2. Research methods and data used
The paper uses the methodology of quality function deployment (QFD–Quality function Deployment) [41], which is a flexible method of making a decision on improving the quality of new products. For organoleptic evaluation of the quality of cookie samples, a point scale was used, according to which the structure, appearance, taste, color, smell and appearance in the fracture were determined. Physical and chemical quality indicators were evaluated according to the requirements of GOST 24901-2014 “Cookies. General technical conditions”, using measuring methods of analysis. Marketing research of consumer preferences was carried out by the method of questioning. In the work, samples of oatmeal cookies were used as objects of research.

3. Obtained result
In accordance with the QFD-methodology analyzed the wishes of consumers of Kemerovo in relation to flour confectionery products, in particular to the liver. To identify and predict the requirements of consumers to the quality of flour confectionery products, a marketing study was conducted using a questionnaire. When summarizing and analyzing the survey results, the authors identified the criteria important in the selection of products and set the range of consumer properties. From organoleptic
characteristics for consumers are important: pleasant taste, smell, color; good structure; dimensional stability. Data characteristically in the "house of quality" in the category of "consumer Expectations".

For each expectation, weight coefficients are determined on a 5-point scale, in which 5 corresponds to the assessment of "very important", 4 – "important", 3 – "less important, but I would like", 2 – "not very important", 1 – "not important".

Among the economic indicators for consumers, the affordable price of the product is important, the ergonomic expectations of the consumer were expressed in indicators – health benefits, convenience of consumption (the availability of individual packaging for each product).

The second stage of research was to determine the comparative value of the developed products – enriched oatmeal cookies. A distinctive feature of enriched cookies is the inclusion in the formulation of vitamin and mineral premix "Valetek-8" the Choice of premix is based on meeting the expectations of consumers in the economic indicator – an affordable price of the finished product. This premix of domestic production, characterized by an affordable price, is designed to enrich flour products to prevent vitamin - iron deficiency anemia and includes vitamins B1, B2, B6, PP, folic acid, iron, calcium. Premix was made in the amount recommended by the manufacturer. The basis of the premix is wheat flour. The composition of the developed cookies in addition to wheat flour includes oat flour, so to simulate the formulation of cookies with premix varied amount of flour. In this regard, several samples of cookies with different dosages of wheat and oat flour were prepared. The amount of wheat and oat flour was changed in the following proportions: 80:20; 70:30; 60:50; 50:50; 40:60; 30:70. As the base sample corresponding to requirements of normative document, took control sample cookies prepared without any premix.

Quality assessment of cookie samples was carried out on a 5-point scale: 5 – "excellent", 4- "good", 3- "satisfactory", 2 - "unsatisfactory", 1- "bad". Analysis of the data showed that the cookie sample with a ratio of wheat flour and oatmeal 80:20 scored the highest number of points, the remaining samples had lower results in organoleptic characteristics (table 1).

For the initial sample was taken № 1, scored the most points on organoleptic indicators and compared with the sample №2, which took the second position on the results of the evaluation, but also had high scores. The results were made in the section "consumer Assessment".

In the further formation of the matrix, attention was focused on the organoleptic characteristics of the developed product, i.e. high characteristics of the "target values". Further defined "degree of improvement". Analyzing the data, we found the need to improve such indicators as color, taste and appearance in the fracture of the sample № 2.

Table 1. Quality assessment of samples of cookies. *

| Consumer expectations | Consumer assessment |
|-----------------------|---------------------|
| Structure             | 1 2 3 4 5           |
| Appearance (surface condition) | - - K N L D X, O |
| Color                 | - K D N L X O      |
| Taste                 | - K D L O N X      |
| Smell                 | - K D L N X O      |
| View in the fracture  | - K L N D X O      |

* X – sample No. 1, O – sample No. 2, N – No. 3, D - No. 4, L - No. 5, K-No. 6.

For the initial sample was taken № 1, scored the most points on organoleptic indicators and compared with the sample №2, which took the second position on the results of the evaluation, but also had high scores. The results were made in the section "consumer Assessment" (sub-table 2).

In the further formation of the matrix, attention was focused on the organoleptic characteristics of the developed product, i.e. high characteristics of the "target values" (sub-table 3). Further defined "degree of improvement". Analyzing the data, we found the need to improve such indicators as color, taste and appearance in the fracture of the sample № 2.

The next step of the research was to determine the technical requirements of the studied product.
In our case, additional technical characteristics not regulated by the requirements of GOST 24901-2014 "Cookies. General specifications" for enriched cookies were allocated indicators for the purpose of identification: "vitamin B2 content", "vitamin PP content", since these vitamins are contained in the used premix. These indicators reflect the distinctive features of the product and its functional orientation, which consumers expressed in their expectations as an indicator - "health benefits".

In the projected "house of quality", in the section "Technical characteristics" (sub-table 4) made the main technical characteristics of cookies, regulated by the current regulatory document and the proposed additional, which affect the quality and usefulness of cookies (vitamin B2 and PP).

We determined the relationship between consumer expectations and technical characteristics of cookies, using a scale to determine the strength of the relationship values: 9 — strong, 3 – medium and 1 – weak relationship. The results were reflected in the line "total score" (sub-table 5).

When establishing the "priority" of physical and chemical parameters of the studied cookie samples, it was revealed that the characteristics have the highest priority – the mass fraction of total sugar, the mass fraction of fat, as well as the content of vitamins in the product.

4. Conclusion
The developed "House of quality" cookies is shown in figure 1. The data obtained as a result of the research found practical application and formed the basis for the development of technical documentation for enriched products. Technical conditions and technological instruction for enriched cookies are developed, industrial testing of results in production conditions of LLC Konditer Of Kiselevsk of the Kemerovo region is carried out, the patent for the invention is received.

![Figure 1. Structuring customer expectations.](image_url)

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