ASSESSMENT COMPLIANCE OF QUALITATIVE FOOD CHARACTERISTICS TO STANDARD REQUIREMENTS

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Abstract. The goal of the research was to develop a method for assessing the quality of food products on the basis of the results of the study of the chemical and amino acid composition, and characteristics of the raw materials used. For identification of the results the cluster analysis is used. It proved the effects of the models of mathematical prediction using the technology "artificial intelligence" for effective identification of compliance with the regulatory requirements of meat products.

Keywords: quality, amino acid composition, cluster analysis, formulation.

Introduction

In recent years, over the entire world, often products do not comply with the standard. In food formulations, the use of low-grade ingredients instead of raw materials of higher quality and additives of unknown composition of different brands is observed [1; 2]. The practice shows that the quality of these foods is lower compared to the products produced with the regulatory requirements. The quality problem is particularly acute with stuffed meat products [3; 4].

The existing standards establish the quality requirements for the microbiological, sensory and physicochemical parameters: the mass fraction of moisture, protein, fat and other [5; 6]. However, although these indicators are important, they are not enough precise to allow identification of the product. Using of the conformity assessment method for testing the quality of food by the regulatory requirements will help protect the consumers from substandard products. The aim of the work was testing a new methodology for assessing the compliance with the quality indicators of meat products based on modern methods of forecasting.

Materials and methods

At the preliminary stage the analysis of chemical and amino acid composition of raw materials is used in sausage production: meat of beef and pork, beef liver, fat, pork belly, pork skin, soy protein preparations isolated and concentrated, sodium caseinate, protein animal Cat-Pro 95, soya flour, eggs and wheat flour. Based on the number of the analyzed components, a plan was made of the mixture and set intervals varying factors. In the matrix planning dimensionless parameters have been replaced by natural. Based on the data of matrix planning, using the developed program in algorithmic language of Pascal, the factor array was created so that the sum of the components of the main raw material in the formulation was 100 percent. The array contains 17026 options of composite structures. For each variant the content, protein and fat (including in terms of dry matter), amino acid composition (in essential amino acids and hydroxyproline), the amount of essential amino acids (EAA), the ratio of tryptophan: hydroxyproline were calculated. Control oxyproline is needed to assess the presence of connective tissue in meat products, and provides an opportunity to determine the compliance with the regulatory formulation amounts of high-quality meat and food additives. Indicators of protein and fat (in % of dry matter) are characterized by the use of a variety of protein-carbohydrate additives and compliance with the standards for the formulation of quantitative content of pork. Amino acid composition indicates the composition ratio of raw materials in a formulation containing a protein fraction, as each ingredient had used a specific set of amino acids. To assess the effectiveness of the developed method a prototype formulation of sausages was made. Taking into account the possible error in conducting the experimental studies (in technological calculations permitted 5 %) the chemical and amino acid composition of this type of product was calculated. The results of the laboratory analysis and calculated indicators are concluded to the database, consisting of a factor array and functional indices, characterizing the compliance of these regulations of meat products.

Results and discussion

The array data were subject to the cluster analysis. The result revealed a cluster consisting of 61 variants of the compositions. Fig. 1 shows the analyzed cluster interval calculated data (including experimental error) for the formulation sausage located between the indices "standard", and the results of the chemical research and the amino acid composition of the prototype are indicated by the term "sample".

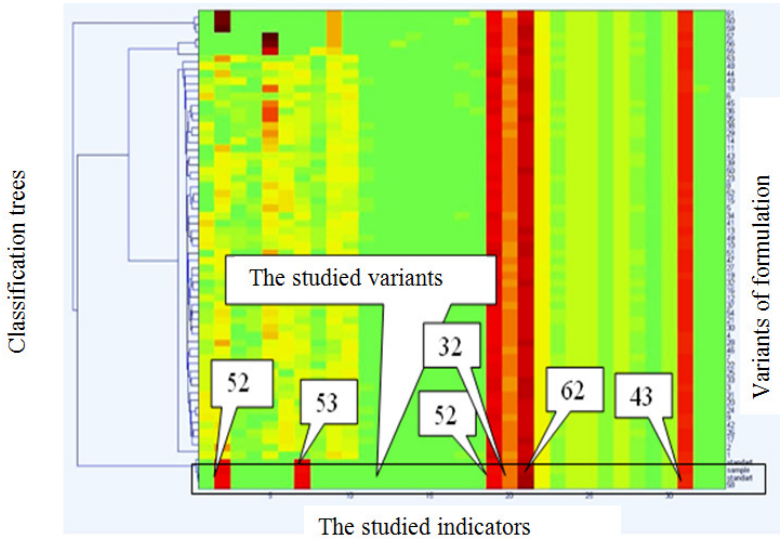

Fig. 1. **Results of clustering study options**

Inside the test range identified four possible compositions do not differ in their color scheme and, therefore, are similar in the quality characteristics to the projection (standard, sample, standard, 58). If the test formulations are a separate group (Fig. 2), the identity of the selected options overlay is shown by diagrams of the samples.

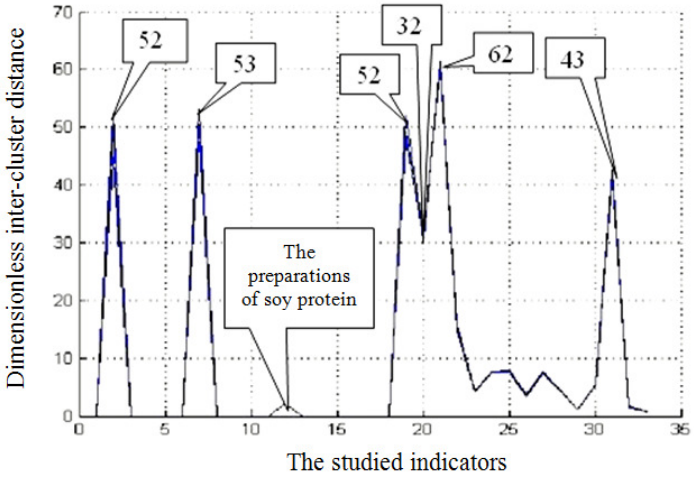

Fig. 2. **Assessment of the qualitative characteristics of the studied compositions**

Despite the visual line of the analyzed variants, the composition number 58 is not located into the range of "standard", this is due to a slight difference between the analyzed indicators of the regulatory requirements. The research factorial indicator sample number 58 showed the presence of a small amount of soy protein products (the studied parameters 12, 13 in Fig. 2).

Effective assessment of the data can be obtained with the self organizing map SOM. These self organizing maps SOM are able to solve the problem of classification without teaching, which is, clustering. Distinctive features of the self organizing maps SOM are a possibility to assess not only the numerical values and text concepts. Therefore, for the developed technique for each type of meat it is advisable to create a separate cluster (cluster is similar to that shown in Fig. 1) and enter into the table an additional column data characterizing each composite option. As a result of the analysis the self

organizing maps SOM are obtained by which it is possible to give a qualitative assessment of the sample.

Fig. 3 is presents the self organizing maps SOM, made by application Deductor Studio Academic. To highlight a string of data in the table any under study option the circle is displayed on the self organizing maps SOM, and on the scale axis "X" text describing this sample is displayed close to standard, but protein of soy is used instead beef grade 1, there is soy flour in the formulation, complete mismatch grade raw meat to standard and so on. On the example, scale axis "X", presents the sample which consistent to regulatory requirements.

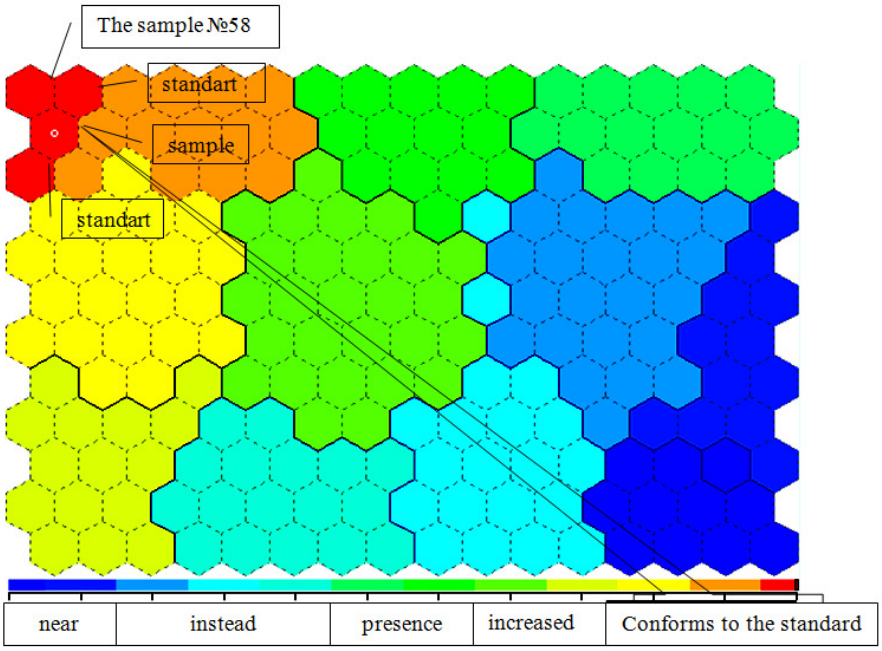

Fig. 3. **Self organizing maps SOM analysis of conformity of formulation of the meat product regulatory requirements**

For sample No. 58 it shows – "contains a small amount of protein of soy close to the standard." The terminology used in the program can be more specific, that is possible to specify the grade of meat and the quantitative content of protein supplements.

Conclusions

In recent years new modern devices are devised to do experimental studies quickly to determine the chemical and amino acid composition of foods. Integrated use of the existing methods and assessment of the quality of the proposed methodology will effectively identify not only meat but also other food products for compliance with the standards.

As a result of the analytical and experimental research in addition to the existing methods for assessing the quality of food products methods of measuring the compliance with the formulation of the analyzed product regulations are developed.

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