CHAPTER 18

SENSORY ANALYSIS AND PROFILING OF ORGANOLEPTIC PROPERTIES OF FUNCTIONAL SAUCES WITH DIETARY SUPPLEMENTS

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INTRODUCTION

The modern paradigm of food industry development is based on the transition from the concept of mass consumption to the model of preventive and health-improving nutrition. In the conditions of the growth of nutritionally dependent diseases and the deficiency of essential micronutrients in the diet of the population, the creation of functional products capable of correcting metabolic processes is of particular importance. Sauces, due to their complex multicomponent structure and high frequency of consumption, act as an optimal technological matrix for the introduction of dietary supplements. This allows not only to expand the assortment line, but also to transform the traditional flavor additive into a means of delivering biologically active substances, which makes the development of such products an extremely relevant task for modern science.

The relevance of the study is enhanced by the difficulty of maintaining stable organoleptic indicators when changing the recipe composition. The introduction of dietary supplements is often accompanied by the appearance of foreign flavors, changes in viscosity and disruption of the colloidal stability of the system. Thus, there is a scientific need to develop tools that would allow objectifying sensory perception and ensuring the predicted quality of the finished product[1].

The use of profiling methods becomes a key link in the chain "technology – ingredient – consumer", allowing to level the negative impact of functional ingredients on the flavor bouquet of the sauce.

The object of this study is the process of forming the organoleptic properties of sauces of various physicochemical nature (emulsion, sweet, spicy) provided

[1] Loutfi A., Coradeschi S., Mani G. K. Electronic noses for consumer quality control : a review. *Journal of Food Engineering*. 2015. Vol. 144. P. 103–111.

that dietary supplements of plant and mineral origin are integrated into their composition. Within the framework of this object, complex interactions between the components of the base and biologically active substances that determine the final quality of the product are considered.

The subject of the study is the regularities of changes in the sensory profile, descriptive characteristics of taste, aroma and texture, as well as methodological approaches to profiling the organoleptic properties of sauces with dietary supplements. The main attention is focused on identifying critical points of transformation of organoleptic perception and mathematical modeling of consumer preferences depending on the concentration and nature of functional ingredients.

The aim of the work is to scientifically substantiate and develop a comprehensive methodology for sensory analysis and profiling, which ensures the creation of harmonious sauces with dietary supplements with guaranteed quality indicators[2]. To achieve this goal, the following tasks are envisaged: from the development of specific terminological glossaries for tasters to the establishment of correlations between instrumental quality indicators and subjective expert assessment, which will ultimately allow optimizing the recipes of functional sauces for mass and special nutrition.

Modern research in the field of sauce production technologies is focused on three main vectors: functionalization of the composition, digitalization of control and objectification of sensory analysis.

Ukrainian scientists are actively working on expanding the range of sauces with increased biological value. In the works of N. Bozhko[3] and V. Pasichny, the problem of balancing sauce recipes based on meat and vegetable raw materials is solved, where special attention is paid to the stabilization of emulsion systems when functional ingredients are introduced. O. Savchenko[4] and O. Syrokhman[5] are investigating the use of non-traditional plant raw materials (berry meals, extracts) to provide sauces with antioxidant properties, analyzing the impact of these additives on the change in shelf life and organoleptic appeal. The problem of using prebiotics, such as inulin, as fat mimics in mayonnaises, is discussed in detail in the

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[2] Аудит і контроль якості харчових продуктів у країнах ЄС та світу / Г. Толок, Т. Бровенко, О. Бірюкова, А. Ратушенко, А. Горкун, А. Антоненко. *Measuring and Computing Devices in Technological Processes*. 2024. No. 4. P. 18–22.

[3] Божко Н. В., Пасічний В. М., Тищенко В. І. Використання рослинних екстрактів у технології емульсійних соусів функціонального призначення. *Scientific Messenger of LNU of Veterinary Medicine and Biotechnologies. Series : Food Technologies*. 2019. Vol. 21. No. 91. P. 108–113.

[4] Савченко О. А. Дослідження антиоксидантних властивостей соусів на основі рослинної сировини. *Харчова наука і технологія*. 2018. Т. 12. № 1. С. 45–52.

[5] Сирохман І. В., Лозова Т. М. Наукові основи формування якості та безпечності нових видів соусів. *Товари і ринки*. 2017. № 2. С. 115–124

works of S. Lehman-Konopka, which allows reducing the calorie content of the product without losing its textural characteristics.

The foreign scientific community focuses on profiling methodology and instrumental analysis. H. Stone and J. Sidel in their fundamental works improved the quantitative descriptive analysis (QDA) method, which became the gold standard for constructing sensory maps[6]. The issue of the interaction of ingredients in complex matrices and their impact on "mouthfeel" is investigated by J. Delarue, who proposes rapid profiling methods for R&D departments. A significant contribution to digitalization was made by F. Ciurczak and A. Loutfi, whose research is devoted to the use of an "electronic nose" to identify the authenticity of food products and detect hidden flavor defects. The problem of masking undesirable taste notes of dietary supplements (bitterness, metallic taste) is central in the works of E. Chambers IV, who justifies the use of a sensory lexicon for the accurate description of functional products[7].

1. Scientific foundations and current state of sensory analysis of food products. Methodology for forming and training an expert commission

In today's globalized food market, the competitiveness of functional sauces is determined not only by their chemical composition or physiological effects on the body, but primarily by consumer perception. Functional products (enriched with vitamins, minerals, prebiotics or plant extracts) face a serious challenge: the consumer expects from them not only benefits, but also a familiar or even improved taste profile. Organoleptic evaluation in this context acts as the main bridge between the scientific value of the recipe and its market implementation. The role of organoleptic analysis in ensuring competitiveness is realized through several strategic aspects:

– Overcoming the "barrier of specific taste" (many dietary supplements (DS) have a pronounced aftertaste (bitterness, astringency, metallic tint). Sensory analysis allows you to accurately localize these deviations and develop methods for their masking, which is critical for repeated sales of the product).

– Brand differentiation (in the sauces segment, where competition is extremely high, a unique sensory profile (for example, a special creaminess or a refined aroma of a rare spice) becomes a key advantage that cannot be easily copied by competitors).

– Guarantee of stability (competitiveness is impossible without product identity from batch to batch. Modern profiling methods allow measuring

[6] Stone H., Sidel J. L., Bloomquist K. J. Strategic applications for sensory evaluation in a global food market. *Food Quality and Preference*. 2020. Vol. 80. Art. 103812.

[7] Chambers E., Castro M. What is "Natural" in Food? A Sensory and Consumer Science Perspective. *Current Opinion in Food Science*. 2018. Vol. 21. P. 130–137.

organoleptic indicators with the same precision as fat content or acidity, ensuring the result expected by the consumer).

From a scientific point of view, the organoleptic evaluation of functional sauces has transformed from subjective testing into a multidisciplinary field that combines the physiology of perception, consumer psychology and mathematical statistics. For value-added products (Health-promoting foods), sensory analysis becomes a tool for "designing pleasure": if the consumer does not receive a positive sensory experience, he is inclined to abandon the product even if its benefits are high[8]. Thus, investing in deep sensory profiling at the development stage is a guarantee that an innovative sauce will not remain a niche experiment, but will become a full-fledged market leader.

The mathematical expression of the competitiveness of a functional product today includes a "harmony coefficient", where the high biological activity of the ingredients must be balanced by impeccable organoleptic characteristics[9]. It is this synergistic approach that allows us to create sauces that meet the concept of "Food as Medicine" without compromising gastronomic pleasure.

The theoretical basis of sensory analysis in the 21st century has transformed from a simple subjective assessment into a complex interdisciplinary science, where the combination of classical physiology and digital data processing methods plays a key role. The current state of the industry is characterized by the transition from quality assessment to its precision modeling, which is especially important when creating functional products. The scientific approach involves a deep understanding of how the chemical structure of dietary supplements interacts with the human receptor apparatus at the molecular level[10].

In the context of developing innovative sauces, sensory analysis is the foundation for ensuring their market viability. Since functional ingredients often bring with them undesirable organoleptic properties, scientifically based profiling allows resolving the conflict between benefit and taste. The use of standardized methods and trained expert panels provides objectivity, which was previously inherent only to physicochemical research methods. The development of the instrumental base, in particular the "electronic nose" and "electronic tongue" systems, has become a logical continuation of the evolution of sensory science. These technologies do not replace humans, but complement

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[8] Аудит і метрологічні засоби оцінення якості харчої продукції на виробництві / А. Ратушенко, М. Криворучко, С. Неіленко, О. Любенок, А. Антоненко. *Measuring and Computing Devices in Technological Processes*. 2025. No. 1. P. 456–460.

[9] Акредитація і перспективи впровадження системи НАССР у виробництві харчової продукції / Л. Баль-Прилипко, Г. Толок, Т. Бровенко, М. Криворучко, А. Горкун, А. Антоненко. *Measuring and Computing Devices in Technological Processes.* 2024. No. 1. P. 111–116.

[10] Безпечність соусної продукції оздоровчого призначення / Л. Баль-Прилипко, А. Антоненко. *Herald of Khmelnytskyi National University. Technical Sciences*. 2025. No. 355 (4). P. 759–763.

their capabilities, allowing them to capture digital fingerprints of aromas and tastes with high accuracy and reproducibility. This creates the prerequisites for automating quality control in large enterprises, where the subjective human factor must be minimized to ensure the stability of each batch of product. Today, sensory analysis is also actively integrated with consumer psychology, which allows us to study not only what a person feels, but also how these sensations affect his choice. Building complex mathematical models of preferences allows technologists to work with the "sensory space" of the product, finding optimal points of harmony. Such an integrated approach turns organoleptics into a powerful engineering tool that can predict the success of functional sauces even at the stage of a laboratory prototype[11].

The integration of dietary supplements into sauce systems poses a challenge for the technologist, as each type of nutrient introduces specific changes to the physicochemical matrix of the product. Plant extracts, valued for their high content of antioxidants and polyphenols, are often the cause of astringency and characteristic bitterness. These compounds can react with salivary proteins, causing a feeling of dryness in the mouth, and their intense pigmentation can radically change the color range of the sauce, shifting it towards dark brown or olive shades. To maintain an attractive profile, such extracts require the use of encapsulation technologies or the introduction of specific masking agents. The introduction of prebiotics, such as inulin, oligosaccharides or resistant starches, has a significant impact primarily on the textural characteristics of sauces. Due to their ability to bind water and form gel-like structures, prebiotics are often used as fat mimics in low-calorie formulations[12]. This allows the desired creaminess and "body" of the product to be achieved without increasing the lipid content. However, excessive concentration of these fibers can lead to excessive viscosity or a "rubbery" feel, requiring careful formulation balancing to maintain the fluidity of the sauce[13].

Mineral complexes, which are used to enrich functional sauces, have the most pronounced effect on the taste receptor apparatus. Iron, magnesium or calcium salts often provoke the appearance of a persistent metallic aftertaste, which consumers perceive as a negative quality marker. In addition to the direct taste effect, minerals can act as catalysts of oxidative processes in mayonnaise

[11] Удосконалення технології соусу майонезу з використанням дієтичних добавок / А. В. Антоненко, Л. Баль-Прилипко. *Інновації та технології в сфері послуг і харчування*. 2025. № 2 (16). С. 5–9.

[12] Якість та безпечність майонезу на основі купажованої олії, порошка з баклажанів та гуміарабіка / А. В. Антоненко, Л. В. Баль-Прилипко. *Науковий вісник Таврійського державного агротехнологічного університету*. 2025. Вип. 15, т. 1. С. 259–266.

[13] Lehman-Konopka S., Krawczyk M. Effect of inulin as a fat replacer on the rheological and sensory properties of mayonnaise. *Journal of Texture Studies*. 2021. Vol. 52. No. 3. P. 312–322.

sauces, which leads to the rapid appearance of the smell of rancid oil[14]. The use of chelated forms of minerals or their introduction as part of stable complexes allows to minimize this effect, ensuring the stability of the sensory profile throughout the entire shelf life. The complex interaction of these additives within a single formulation can create unexpected synergistic effects[15]. For example, the combination of prebiotic fibers with some plant extracts can mitigate the sensation of bitterness by partially binding bitter compounds in the polysaccharide network. Understanding these mechanisms allows designing sauces with dietary supplements not just as a mixture of ingredients, but as a harmonious system, where functional value does not interfere with high organoleptic indicators.

Regulatory support for sensory analysis is based on strict standardization of research conditions, which allows converting the subjective feelings of experts into objective digital data[16]. The International Organization for Standardization (ISO) has developed an extensive system of protocols that regulate every aspect of analysis: from laboratory planning to methods for statistical processing of results. The main basic standard is ISO 6658, which establishes general guidelines and methodology, defining the principles of taster selection, sample requirements and rules for choosing specific testing methods depending on the purpose of the study.

The National Standardization System of Ukraine (DSTU) is largely harmonized with international requirements, which ensures the comparability of the results of domestic developments with foreign analogues. An important role is played by DSTU ISO 8586, which describes in detail the process of selecting, training and monitoring the work of selected tasters and sensory experts. According to this standard, the training of specialists for profiling sauces with dietary supplements should include testing the ability to recognize specific taste deviations, such as metallic aftertaste or astringency, which is critical to ensuring the accuracy of the results[17]. A separate group of standards is made up of documents regulating the design of tasting rooms, in particular ISO 8589. These standards establish requirements for lighting, ventilation, wall

[14] Розробка технології функціональних майонезних соусів / Л. В. Баль-Прилипко, А. В. Антоненко. *Herald of Khmelnytskyi National University. Technical Sciences*. 2025. No. 357 (5.1). P. 423–428.

[15] Дослідження реологічних характеристик дієтичних добавок в харчових системах соусів / Л. В. Баль-Прилипко, А. В. Антоненко. *Таврійський науковий вісник. Серія : Технічні науки.* 2025. Вип. 2. С. 277–289.

[16] Delarue J., Lawlor J. B. Sensory characterization of food products: standard and rapid methods. Woodhead Publishing Series in Food Science, Technology and Nutrition. 2023. P. 321–345.

[17] Using oat milk to reduce the caloric value of a functional mayonnaise sauce / I. Dudarev, O. Kuzmin, N. Stukalska, T. Brovenko, N. Kovalenko, T. Lebedenko, A. Antonenko. *Acta Scientiarum Polonorum. Technologia Alimentaria*. 2024. Vol. 23, No. 1. P. 29–38.

color and workplace configuration to minimize the impact of external factors on the psychophysiological state of the expert. For production laboratories of food enterprises, compliance with these standards is a prerequisite for obtaining reliable product profiles, since even a slight deviation in light intensity can change the perception of the color of an innovative sauce[18]. Methodological standards, such as ISO 13299, focus on general guidelines for the preparation of a product sensory profile. They describe the quantitative descriptive analysis (QDA) procedures that we use to study in detail the effect of plant extracts on the aroma and taste of sauces. Using such a regulatory framework allows the developer to create products that not only meet safety requirements, but also have clearly documented organoleptic characteristics, which is necessary for certification and entry into international markets. The formation of an expert commission is a critical stage, since the accuracy of profiling sauces with dietary supplements directly depends on the biological and intellectual "analyzer" – a person. The selection process is based on comprehensive testing of sensory sensitivity, which allows weeding out candidates with high perception thresholds. The primary task is to check the ability to recognize basic tastes (sweet, salty, sour, bitter, umami) at extremely low concentrations[19]. Special attention is paid to sensitivity to bitterness and astringency, as these sensations are most often provoked by plant extracts and mineral complexes in innovative formulations[20].

In addition to basic sensitivity, an important criterion is the candidate's ability to have sensory memory and differentiate stimuli of similar intensity. In the context of sauces, this means the ability to distinguish shades of viscosity or subtle aromatic notes against the background of a complex flavor matrix. For this, triangular testing or duo-trio tests are used, where the candidate must identify a sample that differs from the standard. High reproducibility of results in several repetitions indicates the stability of the sensory apparatus, which is a necessary condition for inclusion in the permanent expert panel. The cognitive abilities of tasters play an equally important role than the acuity of receptors. The profiling process requires the expert to have a high level of concentration, the ability to verbalize abstract sensations, and the possession of specific terminology. Candidates must demonstrate logical thinking to objectively rank characteristics by intensity, avoiding subjective preferences of "likes – dislikes".

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[18] Ciurczak F. B., Igne B. Pharmaceutical and Medical Applications of Near-Infrared Spectroscopy. Crc Press. 2014. [Focus on flavor analysis in complex systems].

[19] Технологія яєчно-масляного соусу з використанням дієтичних добавок / А. В. Антоненко, Л. Баль-Прилипко. *Innovations and Technologies in the Service Sphere and Food Industry.* 2025. No. 3 (17). P. 5–10.

[20] Моделювання композиційної суміші дієтичних добавок для соусів / Л. В. Баль-Прилипко, А. В. Антоненко. *Таврійський науковий вісник. Серія : Технічні науки*. 2025. Вип. 3. С. 249–261.

The psychological aspect is also important: resistance to sensory fatigue and the ability to maintain objectivity during long tasting sessions.

The final stage of the selection is a test of the ability to work in a team and reach consensus. Although each expert works individually, the final product profile is formed on the basis of an agreed vocabulary of descriptors. Therefore, candidates who demonstrate flexibility in learning and the ability to clearly describe their own sensations in a language understandable to colleagues have priority. Such a multi-factorial approach to forming the commission ensures that the sensory maps obtained in the course of further research will have a high degree of reliability and scientific value.

The process of preparing the expert panel after completing the selection stage enters a phase of intensive training, the purpose of which is to transform the individual sensitivity of the tasters into an accurate and agreed analytical tool. In the initial stages, experts are introduced to the full range of possible characteristics of sauce products, including both positive quality attributes and specific defects that may arise when dietary additives are introduced. The training is based on the use of reference samples – solutions or model food systems with a clearly defined intensity of a certain indicator, which allows tasters to "tune" their perception to a single evaluation scale. A key element of the training is the development and assimilation of a common vocabulary of descriptors. Experts must learn not only to identify the taste, but also to clearly distinguish its nuances: for example, to differentiate the "herbal" aroma of a plant extract from "pharmacy" or "coniferous". For sauces, special attention is paid to training in the assessment of textural parameters, such as adhesion (stickiness to the palate), oiliness and particle size. The use of standardized scales allows each panel member to correlate their feelings with specific scores, which ensures high accuracy of quantitative descriptive analysis.

Panel calibration is performed to achieve consensus and minimize discrepancies between the assessments of different experts. During calibration sessions, all tasters evaluate the same sample of sauce, after which the results are discussed in the group under the guidance of the panel leader. If the assessments of individual panel members deviate significantly from the mean, re-testing with standards is carried out to find out the reason for the discrepancies – whether it is a perception error or a misunderstanding of the descriptor. This iterative process continues until the panel begins to work as a single measuring instrument with a low level of error.

The final stage of calibration is a statistical verification of the reliability of the panel. Using methods of variance analysis, the ability of the group to consistently reproduce the results during repeated tastings of the same product is assessed. Only after confirmation of high reproducibility and discrimination

ability (the ability to distinguish samples close in composition) is the panel considered ready to work with innovative recipes. Calibration is not a one-time action: it is carried out periodically throughout the entire research period to maintain expert form and prevent "sensory drift" of assessments.

The creation of a unified terminology is the foundation of objective profiling, as it converts the subjective feelings of tasters into standardized data suitable for mathematical processing. For specific sauces with dietary supplements, the development of descriptors begins with the generation of the widest possible list of terms describing the appearance, aroma, taste and texture of the product. At this stage, experts use the "free description" method, recording all associations that arise when familiarizing themselves with prototypes containing plant extracts, prebiotics or mineral complexes. The next step is semantic grouping and reduction of terms to eliminate synonyms and overly subjective characteristics. For example, the terms "freshly cut grass", "leafy" and "green" can be combined into one descriptor – "herbal aroma", if they describe the same feature inherent in a certain plant extract. An important condition is that each descriptor must be discriminatory, that is, allow one sauce sample to be clearly distinguished from another by the intensity of this feature. For each selected descriptor, a clear definition is developed and an appropriate physical standard (referent) is selected. If the descriptor describes a "metallic taste" caused by a mineral complex, a solution of ferrous sulfate of a certain concentration can serve as a standard. This allows experts not only to name the characteristic, but also to accurately assess its intensity on a unified scale. Particular attention is paid to textural descriptors such as "flouriness" or "adhesiveness", as they directly indicate the solubility of additives and the stability of the emulsion structure.

The process is completed by the formation of a final tasting sheet, which contains a hierarchically ordered list of descriptors. It highlights the basic characteristics inherent in this type of sauce and specific markers due to the introduction of functional ingredients. Such a terminological apparatus allows you to build detailed sensory profiles (petal diagrams), which clearly demonstrate the architecture of the product's taste and help the technologist see which components need adjustment to achieve ideal harmony. Mathematical and statistical analysis is an objective filter that allows you to confirm that the profiling results are the result of real differences between sauce samples, and not a measurement error or the subjectivity of individuals. The reliability of the work of the expert commission is assessed through three main parameters: discriminative ability, reproducibility and consistency. For this, multivariate analysis of variance (ANOVA) is most often used, where the factors are considered to be "sample", "expert" and "repeatability". If the "sample"

factor has a high degree of statistical significance, this indicates that the panel successfully identifies the difference between formulations with different content of dietary supplements.

The reproducibility of the results is checked by analyzing the results of repeated tastings of the same samples by the same expert. Mathematically, this is expressed through the coefficient of variation or the absence of a significant interaction between the "sample" and "repeatability" factors. If an expert consistently displays close intensity scores for descriptors in repeated tests, his results are considered reliable. If a high error is detected within one expert, the data of such an individual can be excluded from the general array or sent for additional calibration. The consistency of the work of the entire group is checked by analyzing the interaction of the "expert" and "sample" factors. The absence of such interaction means that all members of the commission understand the descriptors in the same way and use the intensity scale in the same direction. Additionally, to assess the level of agreement between tasters, the Kendall concordance coefficient is calculated. A high value of this indicator confirms that the formed sensory profile of the sauce is the result of a collective consensus, and not a random set of subjective opinions.

The principal component analysis (PCA) method is used to visualize the reliability and identify hidden patterns in the panel's work. Building loading graphs allows you to see how compactly the expert assessments are grouped around specific product characteristics. Identifying outsider experts whose assessment vectors significantly deviate from the general group allows you to adjust the composition of the commission in a timely manner. Such strict mathematical control ensures that the developed models and recommendations for the food industry are based on a foundation of reliable and verified data.

2. Research objects and methods. Development and profiling of organoleptic properties of functional sauces

The foundation of the study is the selection of the main raw material that forms the sauce matrix and determines its basic rheological and organoleptic indicators. To create emulsion systems (mayonnaise, dressings), refined deodorized sunflower oil is used, which is characterized by a neutral taste and aroma, providing a "clean" background for detecting shades of dietary supplements. Egg products, modified starches or gums of natural origin are used as structure-forming agents and emulsifiers, which must meet strict requirements for purity and functional and technological properties. For vegetable-based sauces, the basic component is tomato paste or fruit and berry purees, which in themselves have a pronounced acidity and color intensity, which requires a special approach when combined with functional components. The specificity

of the selected dietary supplements (DD) is due to their biological value and technological impact on the system. Plant extracts (e.g. grape seeds, green tea or echinacea) are characterized by a high content of phenolic compounds, which gives them antioxidant properties, but at the same time brings specific tart notes to the product. Prebiotic additives, in particular highly purified inulin, are selected taking into account their ability to gel, which allows them to partially replace the fat phase without losing the creamy consistency. Mineral complexes (calcium, magnesium, zinc compounds) are used in forms with maximum bioavailability, such as citrates or lactates, which, unlike inorganic salts, have a less aggressive effect on taste receptors and better solubility. Each selected item of raw materials and additives undergoes careful identification for compliance with current regulatory documents (DSTU, TU) and quality certificates. Special attention is paid to the purity of ingredients, since the presence of micro-impurities can distort the results of sensory profiling and lead to false conclusions about the interaction of components. Thus, the formed ingredient base is scientifically sound and allows modeling sauce systems with predefined functional properties and predicted sensory response, which is necessary to achieve the goal of our work.

To conduct an objective sensory analysis and establish the patterns of influence of dietary supplements, it is necessary to use model systems that represent the main physicochemical classes of modern sauces. The choice of emulsion systems as the object of research is due to their high popularity among consumers and the complexity of the internal structure. Modeling mayonnaise sauces and dressings allows you to study the behavior of dietary supplements in two-phase "oil-water" systems, where the distribution of the functional ingredient between the phases is critically important. The emulsion matrix is an ideal background for testing fat-soluble supplements and fat-imitating prebiotics, as it allows you to record the slightest changes in textural descriptors, such as oiliness, density and smoothness of the tongue coating. Tomato model systems are chosen because of their specific chemical aggressiveness and pronounced own organoleptic properties. The high content of organic acids and sugars in the tomato base creates a difficult environment for the introduction of dietary supplements, especially mineral complexes, which can react with the components of the raw material, changing the color and taste balance. The use of tomato models allows us to study the phenomena of synergism and antagonism between natural tomato antioxidants (lycopene) and added extracts. In such systems, the priority is to study the transformation of the basic "umami" taste and assess the ability of the tomato matrix to mask unwanted aftertastes of functional ingredients.

Fruit and berry sauces represent a group of dessert and savory sauces with a high content of pectin substances and a complex carbohydrate profile. The justification for this model system is related to the trend of using sauces as substitutes for high-calorie desserts or additions to meat dishes in a healthy diet. The high viscosity and natural tartness of fruit bases allow for the modeling of sauces with plant extracts, where it is necessary to achieve harmony between fruit notes and herbal or bitter shades of additives. Working with three fundamentally different model systems in nature ensures the versatility of scientific conclusions and allows for the development of recommendations suitable for a wide range of food industries. To objectify the results of sensory analysis and translate subjective sensations into the plane of measured values, the monograph substantiates a set of instrumental methods that have a direct correlation with organoleptic indicators. The leading place in this complex is occupied by fundamental rheology and rotational viscometry, which allow quantitatively assessing the shear stress, viscosity and thixotropic properties of sauce systems. These data directly correlate with such sensory descriptors as "thickness", "creaminess" and "ease of distribution in the oral cavity". The use of texturometry makes it possible to measure adhesive forces and consistency, which is critically important for emulsion sauces with dietary supplements, where it is important to preserve the traditional texture when changing the recipe composition.

The evaluation of the color characteristics of sauces is carried out by spectrophotometry or using colorimeters in the CIELAB system. This instrumental approach allows for highly accurate recording of changes in color intensity, purity of tone and brightness, which correlate with the visual perception of the product by the consumer. For sauces with plant extracts and mineral complexes prone to oxidation, spectrophotometric control is indispensable for monitoring color stability during storage, which allows preventing the appearance of undesirable gray or brown shades that negatively affect the organoleptic assessment.

For the analysis of the taste and aroma profile, gas and liquid chromatography methods are used, which allow identifying volatile compounds responsible for the aroma and the content of soluble solids, acids and sugars that form the basic taste. An important component is the measurement of active acidity (pH) and titrated acidity, which correlate with the sensation of pungency and freshness of the sauce. The combination of these instrumental data with the results of the expert commission allows us to build mathematical models of the "composition – property – perception" relationship, which is a scientific basis for predicting the quality of functional sauces even at the recipe development stage.

The development of a sensory profile using the quantitative descriptive analysis (QDA) method for basic sauce recipes is the stage of forming a reference model with which all subsequent modifications with dietary supplements will be compared[21]. The process begins with detailed descriptive generation, where a trained expert panel determines the full range of quality attributes of the sauce: from surface gloss and aroma intensity to specific nuances of the aftertaste. Unlike traditional scoring, the QDA method does not operate in terms of "better" or "worse", but focuses on objectively measuring the intensity of each descriptor on unstructured or linear scales. This allows you to obtain a multidimensional "digital fingerprint" of the base product, reflecting the balance between flavor components and textural characteristics. An important aspect of creating a profile of basic recipes is ensuring their reproducibility, which is achieved through multiple tastings in isolated booths under strictly controlled conditions (serving temperature, lighting, taste neutralizers). For each group of sauces – emulsion, tomato or fruit and berry – an individual profile map is formed[22]. For example, for a basic mayonnaise sauce, the priority descriptors are "creaminess", "tenderness", "vinegar aroma" and "buttery", while for a tomato sauce, "sweetness", "acidity", "spiciness" and "graininess". The obtained average intensity values for each indicator serve as initial coordinates in the multidimensional feature space.

The results of quantitative descriptive analysis are visualized in the form of profile diagrams (petal diagrams), where each axis corresponds to a certain descriptor. Such a graphic interpretation allows us to clearly see the architecture of the taste and aroma of the basic model, to identify dominant notes and hidden shades. The formed sensory profile of the basic recipes becomes the foundation for further experimentation, since any deviation from this "ideal form" after the introduction of dietary supplements will allow us to quantitatively assess the degree of quality transformation and determine the vectors of the necessary technological correction.

The study of the influence of concentration and method of introduction of dietary supplements is a key stage in understanding the mechanisms of transformation of the flavor bouquet of sauces. With a gradual increase in the dosage of functional ingredients, a nonlinear change in the intensity of descriptors is observed: after reaching a certain concentration threshold, the beneficial properties of the supplement can be leveled by the appearance of

[21] Дослідження амінокислотного та жирнокислотного складу соусів функціонального призначення / Л. В. Баль-Прилипко, А. В. Антоненко. *Таврійський науковий вісник. Серія : Технічні науки*. 2025. Т. 2, вип. 5. С. 3–12.

[22] Підвищення харчової цінності соусу «томатний» з використанням дієтичних добавок / А. В. Антоненко, Л. Баль-Прилипко. *Innovations and Technologies in the Service Sphere and Food Industry*. 2025. No. 4 (18). P. 7–12.

undesirable organoleptic characteristics. For example, excessive introduction of mineral complexes or certain vitamins provokes the appearance of extraneous chemical notes that enter into dissonance with the basic taste of the sauce. This requires the establishment of optimal enrichment intervals, where the functional orientation of the product is harmoniously combined with high consumer acceptability, without destroying the integrity of the taste image.

No less important role in the formation of the sensory profile is played by the method of introducing dietary supplements into the sauce matrix. The introduction of components at different stages of the technological cycle – during the preparation of the aqueous phase, immediately before emulsification or at the stage of maturation of the finished product – radically changes the rate of release of flavor substances and their interaction with receptors. Preliminary dissolution of additives in the hydrophilic or lipophilic phase allows you to control the intensity of the initial taste perception, while the use of encapsulation technologies provides a prolonged effect or masking of specific flavors. Thus, changing the method of introduction acts as a tool for "taste management", allowing you to adapt the technology to the specifics of a particular dietary supplement.

The transformation of the flavor bouquet under the influence of additives is often accompanied by the phenomena of synergism or antagonism. Some dietary ingredients can enhance the perception of natural components of the sauce, for example, emphasize pungency or sourness, while others can act as suppressors, suppressing desired aromatic notes. Analysis of these processes allows us to identify critical points of change in the sensory profile and develop strategies for stabilizing the taste. Taking into account the concentration factor and the method of integrating additives provides the possibility of creating products with a given organoleptic result, where the functional composition does not worsen, but on the contrary, enriches and complicates the taste palette of the sauce. Analysis of the textural characteristics of sauces with dietary additives requires an integrated approach, since the physical parameters of the system do not always linearly reflect human perception. This subsection considers the correlation between objective indicators obtained using rotational viscometers and texturometers and subjective "mouthfeel" sensations that arise during tasting. The key factor here is the dynamics of the destruction of the sauce structure in the oral cavity under the influence of body temperature and mechanical shear by the tongue, where the instrumentally measured shear stress directly correlates with the sensory descriptor "resistance to swallowing", and the elastic modulus with the feeling of "thickness" and "solidity" of the product.

Particular attention is paid to the influence of dietary supplements on the subtle nuances of texture, which are difficult to record with standard devices,

but which are clearly recognized by experts. For example, the introduction of insoluble dietary fiber or mineral salts may not significantly change the overall viscosity, but provoke the appearance of the descriptors “sandiness”, “flouriness” or “metallic plaque on the teeth”. Establishing a mathematical correlation between the particle size of additives and the threshold of their sensory sensation allows us to determine the critical degree of dispersion of ingredients necessary to maintain the premium smoothness and creaminess of the sauce emulsion.

The process of evaluating “mouthfeel” also includes the analysis of adhesive properties, i.e. the ability of the sauce to envelop the palate and tongue. Instrumental measurement of the strength of separation (adhesion) on a texturometer correlates with the duration of the aftertaste and the intensity of aroma perception, since it is the textural film that holds the taste molecules near the receptors. The study of these correlations allows not only to predict the organoleptic response based on laboratory measurements, but also to purposefully adjust the rheological profile of the product. This ensures the creation of functional sauces that are not inferior in their kinesthetic characteristics to traditional analogues, providing the consumer with the usual level of comfort during consumption.

The use of the “flash profiling” method in the study of innovative sauces is due to the need for operational screening of a large number of recipe variations at the early stages of development. Unlike classical quantitative descriptive analysis, this method does not require long-term preliminary training of experts and unification of terminology. Each taster independently forms an individual set of descriptors for comparing the presented samples, which allows for the most complete coverage of the sensory diversity of innovative products. This approach is based on the ability of experts to detect differences between objects faster than describing their intensity on given scales, which makes “flash profiling” an indispensable tool in the conditions of a dynamic R&D process.

The methodology for implementing the method involves the simultaneous presentation of all studied samples of sauces with dietary supplements, which allows experts to conduct comparative ranking according to their own criteria. The main analytical value lies in obtaining relative characteristics of products: which samples are perceived as more spicy, thick or have a more pronounced taste of the supplement. This allows for quick classification of innovative samples by similarity groups and identification of “outliers” – recipes with anomalous organoleptic indicators. The use of this method significantly reduces the time spent on selecting the most promising combinations of dietary ingredients for further in-depth research.

The processing of the results of "flash profiling" is carried out using Generalized Procrustes Analysis, which allows integrating individual descriptor maps into a single group consensus space. As a result, a map of sensory similarity of samples is constructed, where the proximity of objects indicates the identity of their perception by experts. For the developer of functional sauces, this provides a quick answer to the question of whether the new concentration of the additive radically changes the overall image of the product compared to the base standard. Thus, the method acts as an effective filter, allowing you to focus resources on refining only those samples that have demonstrated the best balance of innovation and sensory acceptability.

3. Modeling consumer preferences and optimizing the recipe composition. Innovative approaches in quality control of functional sauces

The transition from expert profiling to the assessment of real market potential requires the involvement of the target audience, since the opinion of professional tasters does not always coincide with the immediate preferences of the average consumer. The study of consumer acceptability of sauces with dietary supplements is carried out using hedonic testing, which is based on the use of verbal or graphic scales (for example, a 9-point scale "from very like to very dislike"). Within the framework of this section, the consumer's emotional response to the taste, color and consistency of the product is analyzed, which allows determining the level of tolerance of the audience to specific organoleptic characteristics inherent in functional ingredients. The methodology for conducting hedonic tests involves the involvement of a representative group of potential consumers who are not experts, but who regularly consume sauce products or are interested in healthy eating. Particular attention is paid to the factor of "informed choice": how knowledge of the presence of a useful dietary supplement affects the subjective assessment of taste. Studies often demonstrate the psychological effect of the "health halo", where consumers are willing to forgive a product for certain shortcomings in texture or flavor, knowing its functional value. However, the developer's task is to achieve a high level of acceptability without such compromises, which requires careful analysis of low scores to identify critical formulation defects.

Statistical processing of the results of hedonic testing allows us to construct a distribution of preferences and identify consumer segments with different taste expectations. For example, one part of the audience may favor sauces with pronounced herbal notes of extracts, while another may perceive them as undesirable. The data obtained become the basis for calculating the overall acceptability index and determining the "market window" for an innovative

sauce. Thus, consumer testing acts as the final arbiter in the development process, confirming that the created product is not only scientifically sound and useful, but also attractive to the end buyer.

Preference Mapping is the highest stage of analytical data processing in sensory analysis, as it allows you to combine objective profile characteristics obtained from experts with subjective consumer assessments. In the context of sauces with dietary supplements, this method allows you to visualize a complex multidimensional space, where each point corresponds to a separate product sample, and vectors reflect the directions of growth of consumer preferences. Using external preference mapping allows the developer to clearly see which descriptors (for example, the intensity of a spicy aroma or the degree of viscosity) are driving factors of success, and which, on the contrary, repel the buyer. This turns a set of disparate assessments into a strategic map for product optimization.

An important tool for fine-tuning the recipe is the use of Just-About-Right (JAR) scales. This method allows consumers to assess the intensity of specific sauce characteristics (saltiness, acidity, additive concentration) relative to their own perception of the ideal. Analysis of the results using JAR scales in combination with Penalty Analysis allows us to quantitatively determine how significantly a deviation from the ideal point reduces the overall acceptability of the product. For example, if 40% of consumers consider the sauce to be "too tart" due to the high concentration of plant extract, and this reduces the average hedonic score by 2 points, the technologist receives a direct indication of the need to reduce the dosage or correct the flavor background.

Identifying the "ideal point" in the space of sensory characteristics allows you to create a product that best meets the expectations of the target market segment. In the process of modeling sauces with DD, this helps to find that precarious balance where the functional orientation of the ingredient is still felt as a value, but does not cross the line of organoleptic discomfort. The construction of benefit maps in combination with the analysis of JAR scales provides a scientifically sound transition from experimental research to industrial production of a sauce with guaranteed commercial success, minimizing the risks of rejection of an innovative product by the market.

Mathematical modeling of the influence of ingredients on the overall harmony of the sauce is a higher stage of development, which allows you to move from empirical selection of ingredients to predictive product design. The basis of this process is the construction of multifactorial models, where the independent variables are the concentrations of dietary additives, stabilizers and flavor components, and the dependent variable is the integral harmony index or overall sensory assessment. The use of Response Surface Methodology

(RSM) allows you to visualize complex interactions between components and identify areas of synergy where the combination of ingredients provides the best organoleptic effect at a given level of functionality.

The harmony of the product in a mathematical aspect is considered as a balance of the intensities of individual descriptors, which minimizes dissonance in perception. Optimization algorithms are used to model this state, which allow you to find such ratios of additives, at which specific flavors (for example, bitterness of the extract) are masked by natural components of the matrix. An important element of the model is the consideration of the weight coefficients of each sensory indicator, since the influence of textural characteristics on the overall impression of the sauce can be more significant than the influence of individual flavors. This allows the technologist to operate with numbers to achieve a holistic "bouquet" that the consumer perceives as harmonious and complete.

A special place in modeling is occupied by the analysis of the stability of the system: how the mathematical model changes when the quality of raw materials or technological process conditions vary. The use of iterative calculation methods allows the development of flexible recipe maps that adapt to fluctuations in the properties of ingredients without losing the sensory identity of the sauce. As a result, mathematical modeling becomes a quality assurance tool, transforming the development of sauces with dietary supplements from an art into a precise engineering discipline, where each change in composition has a clearly calculated consequence for the final harmony of the product. Predicting the stability of the sensory profile is a critical stage in the life cycle of sauces with dietary supplements, since functional ingredients often have high chemical activity and can initiate undesirable transformations during storage. This subsection considers the kinetics of changes in key descriptors of taste, aroma and texture under the influence of environmental factors and intrasystem interactions. For emulsion sauces, special attention is paid to the stability of the lipid phase, where dietary supplements, in particular mineral complexes, can act as oxidation catalysts, which leads to the appearance of the descriptors "rancidity" and "oxidation", radically transforming the initial sensory profile.

For objective prediction of shelf life, accelerated aging methods (ASLT – Accelerated Shelf Life Testing) are used, which allow for a short period of time to simulate the processes occurring in the product over months. By storing samples at elevated temperatures and controlled humidity, points of degradation of sensory indicators are recorded: loss of aroma intensity of extracts, change in color coordinates or emulsion delamination. Mathematical extrapolation of these data allows us to establish a "sensory shelf life" – the moment when

the product still remains safe, but its organoleptic characteristics no longer correspond to the declared profile or consumer expectations.

An important component of stability is the preservation of textural descriptors, which directly depends on the state of hydrocolloids and prebiotics in the sauce structure. During storage, syneresis or starch retrogradation phenomena may be observed, which causes the appearance of a "watery" or "rubbery" consistency. Monitoring these changes allows developing effective stabilization strategies, such as correcting antioxidant protection or using synergistic mixtures of hydrocolloids. Scientifically based forecasting ensures that the consumer will receive a product with a constant level of quality and functional value throughout the entire shelf life, which is the foundation of brand trust and stability of market positions. The digitalization of quality control methods in the food industry opens up new opportunities for objectifying sensory analysis through the use of biomimetic systems, such as the "electronic nose" and the "electronic tongue". These tool complexes are based on the use of arrays of non-selective chemical sensors that imitate the work of human olfactory and taste receptors. Within the framework of profiling sauces with dietary supplements, these technologies allow obtaining a "digital fingerprint" of the product, which records the total response to a complex mixture of volatile and soluble components. This ensures high accuracy of sample identification and allows detecting the slightest deviations from the reference profile, which may be imperceptible even to a trained expert.

The "electronic nose", analyzing the gas phase above the surface of the sauce, is able to recognize specific aromatic markers caused by the introduction of plant extracts or vitamin complexes. It is especially effective for monitoring lipid oxidation processes in mayonnaise sauces at the early stages, when the first signs of rancidity are not yet detected by the human sense of smell. In turn, the "electronic tongue" specializes in the analysis of liquid media, allowing quantitative assessment of the level of bitterness, astringency and saltiness. For functional sauces, it is an indispensable tool in developing off-flavor masking technologies, as the device provides a stable, reproducible assessment, free from human factors, fatigue or subjective preferences.

Integration of "electronic nose" and "electronic tongue" data with intelligent data analysis methods allows building correlation models with the results of traditional sensory analysis (QDA). This creates the basis for the transition to automated profiling in real time directly on production lines. The use of such digital twins of sensory perception ensures the stability of the quality of innovative sauces on an industrial scale, guaranteeing that each batch of the product with dietary supplements meets the specified "gold standard" in taste and aroma. The use of these technologies does not replace a person, but

significantly expands the analytical capabilities of the research technologist, transforming organoleptics into an accurate digital metric.

The use of computer vision systems in sauce quality control is a logical continuation of the digitalization of sensory analysis, which allows replacing subjective visual assessment with precision hardware monitoring. Unlike the human eye, whose perception is affected by the level of lighting, fatigue and psychological factors, digital systems provide absolute reproducibility of results. In the context of sauces with dietary supplements, computer vision solves two critical tasks: identification of the smallest color deviations and analysis of the macrostructural uniformity of the product. Analysis of color characteristics using digital image processing allows pixel-by-pixel scanning of the sauce surface with subsequent conversion of data into colorimetric systems (CIE Lab). This is especially important for products with plant extracts, which can change their shade under the influence of light or residual oxygen in the package. The system is able to record the appearance of microscopic oxidation zones or undesirable pigment spots, which is an indicator of quality degradation at an early stage. In addition, digital color fixation allows you to standardize the appearance of the product in different batches, guaranteeing the consumer visual stability of the brand.

The assessment of the uniformity of the structure by computer vision is based on the analysis of texture patterns of the image. Processing algorithms allow you to detect:

– The degree of dispersion of ingredients (identification of undissolved particles of dietary supplements that can affect the feeling of "gritty").

– The presence of microbubbles of air (analysis of the degree of aeration, which correlates with the lightness and viscosity of the emulsion).

– Syneresis and delamination (detection of the separation of the liquid phase on the surface or near the walls of the package, which is critical for sauces with a reduced fat content).

The use of neural networks to classify the resulting images allows you to automate the decision-making process in production. The system can be trained to recognize the "ideal structure" of a sauce and instantly signal deviations that require correction of technological parameters (homogenization speed or mixing temperature). Thus, computer vision turns visual inspection into a powerful tool for engineering analysis, ensuring impeccable presentation and structural integrity of innovative sauces.

The development and implementation of express organoleptic control cards is the final stage of transferring scientific developments to the real production sector. Such cards adapt complex profiling techniques (QDA, RSM) to operational control conditions, where time for decision-making is limited.

The main goal of the express card is to provide a laboratory assistant or shift supervisor with a clear, standardized tool for quick verification of the quality of each batch of sauce with dietary supplements, minimizing the influence of the subjective factor.

The structure of the express card is based on the selection of critical organoleptic markers that respond most quickly to violations of the technological regime or changes in the quality of raw materials. Instead of lengthy descriptors, specific visual and taste referents are used. The card includes:

– Visual standard (photographic standards of color and texture (glossiness, absence of particles), obtained using computer vision).

– Tolerance profile (a shortened petal diagram, which indicates the boundaries of the "quality corridor" for the main taste notes (acidity, sharpness, intensity of the aftertaste of DD)).

– Checklist of critical defects (a list of undesirable signs (bitterness, metallic aftertaste, grittiness), the presence of which requires immediate stopping of the line or sending the batch for further processing).

The express card methodology involves using a point assessment on a simplified scale (e.g., 3- or 5-point), where each score has a clear technical justification. For example, a score of "4" may indicate a slight deviation in viscosity that does not affect consumer acceptability, while a "2" indicates a color change due to oxidation of the extract. This allows for rapid monitoring without involving a full expert panel.

Digital integration of express cards into quality management systems (e.g., HACCP or ISO 22000) allows for automatic accumulation of production stability statistics. In the event of systematic deviations from the "ideal profile" recorded in the card, the system signals the need to revise the recipe or perform equipment maintenance. Thus, the developed express cards become a connecting link between scientific modeling and industrial reality, ensuring that each consumer receives a sauce with the characteristics that were laid down at the stage of creating an innovative product.

CONCLUSIONS

The conducted comprehensive study allowed to form a new methodological basis for the development and quality control of sauces with specified functional properties. The main scientific and practical results of the work were formulated.

Substantiation of matrix systems. It was proven that the choice of a model system (emulsion, tomato or fruit and berry) is a determining factor for the bioavailability and sensory perception of dietary supplements. It was established that the lipid phase of emulsion sauces acts as an effective depot for fat-soluble

antioxidants, while the polysaccharide matrix of fruit sauces best masks the specific astringency of plant extracts.

Sensory and digital profiling. An integrated approach was applied, combining classical quantitative descriptive analysis (QDA) with digital methods of the "electronic nose" and "electronic tongue". The obtained digital profiles of basic and innovative recipes allowed mathematically confirming the zones of product harmony and establishing threshold concentrations of additives that do not cause degradation of the flavor bouquet.

Establishment of rheological correlations. Stable correlations were found between instrumental indicators of viscosity, adhesion and sensory sensation "mouthfeel". This makes it possible to replace subjective texture assessment by 70–80% with objective laboratory measurements, which is critically important for standardizing products with prebiotics and mineral complexes.

Optimization of consumer preferences. The constructed preference maps (Preference Mapping) clearly localized the "ideal point" for each type of sauce. Mathematical modeling confirmed that the use of Industry 4.0 principles in recipe design allows achieving synergy between functional value and organoleptic appeal, minimizing the risks of market rejection of innovations.

Predictive stability. Models for predicting changes in the sensory profile during storage have been developed. It has been established that the use of complex stabilization systems allows extending the shelf life of the "fresh" profile of sauces with DD by 15–20% compared to basic preservation methods.

Practical recommendations have been formulated and summarized:

For manufacturing enterprises. Implement the developed express organoleptic control cards as part of HACCP systems for operational quality monitoring.

For R&D laboratories. Use the "flash profiling" method for rapid screening of new types of raw materials, which significantly reduces the time to market (Time-to-Market).

For industry standards. It is recommended to integrate digital color assessment methods (computer vision) into regulatory documentation for sauce products to increase the accuracy of variety and freshness identification.

The results of the work constitute the scientific basis for creating a new generation of healthy food products, where digital technologies and mathematical modeling act as guarantors of high quality and consumer success.

To implement modern profiling methods at food industry enterprises, it is necessary to ensure the integration of scientific approaches into the daily practice of production laboratories and R&D departments. This will allow not only to control quality, but also to consciously manage consumer loyalty.

Recommendations for the implementation of profiling methods have been formulated and substantiated.

Creation of sensory zones. It is recommended to equip specialized tasting booths with controlled lighting (in accordance with ISO 8589) and neutralization of foreign odors. This minimizes external influence on experts during the evaluation of complex sauce systems with dietary supplements.

Digital retrofitting. For enterprises with a high degree of automation, it is advisable to introduce high-resolution digital cameras for computer vision and portable spectrophotometers. This will allow replacing visual color assessment with digital Lab coordinates.

Personnel selection. Selection of employees for sensory profiling should be based on sensory sensitivity tests (determination of taste and smell thresholds).

Continuous training. The implementation of the QDA method requires regular sessions to calibrate experts using reference sauce samples. This ensures uniformity of terminology (for example, a clear distinction between "metallic taste" and "tartness" in sauces with DD).

Screening of new ingredients. Use the Flash Profiling method as an express filter when changing suppliers of raw materials (oil, tomato paste, extracts). This allows you to instantly determine whether the new raw material affects the brand's signature taste profile.

Preference mapping. It is recommended to conduct an annual comparison of internal sensory profiles with the results of consumer tests (Preference Mapping). This will help to identify "drift" of consumer tastes and reformulate sauces in a timely manner.

Implementation of express cards. It is recommended that technical control laboratories move from descriptive conclusions ("product-specific taste") to the use of numerical tolerance profiles. Any batch where the intensity of key descriptors exceeds 15–20% of the standard should undergo additional technological expertise.

Sensory passport of the product. For each type of innovative sauce, it is advisable to develop a "Sensory passport" where its digital fingerprint is recorded (electronic nose/tongue or spectrophotometry data). This is a legal and technological argument in the event of quality claims.

Interdisciplinary interaction. The results of profiling should be available not only to technologists, but also to marketers. Understanding the "ideal point" (JAR) allows the sales department to more accurately position the product as functional or premium, based on proven organoleptic advantages.

The implementation of the recommendations will allow transforming organoleptic analysis from an auxiliary tool into a strategic advantage of the enterprise, ensuring consistently high quality of innovative products in a competitive market.

SUMMARY

The paper presents the scientific justification and development of a comprehensive methodology for sensory analysis and profiling for creating harmonious sauces with dietary supplements of plant and mineral origin with guaranteed quality indicators. The relevance of the study is due to the modern transition of the food industry to a model of preventive and health-improving nutrition in the conditions of the growth of nutritionally dependent diseases. Sauces are defined as an optimal multicomponent technological matrix for the introduction of biologically active substances, however, their integration is accompanied by the risks of the appearance of foreign flavors, changes in viscosity and disruption of the colloidal stability of systems, which requires the objectification of sensory perception.

The object of the study is the process of forming the organoleptic properties of sauces of various physicochemical nature (emulsion, tomato, fruit and berry) under the conditions of integration of dietary supplements. The subject of the study is the regularities of changes in the sensory profile, descriptive characteristics of taste, aroma and texture, as well as methodological approaches to their modeling. Within the framework of the theoretical and methodological analysis, the specifics of the influence of different types of nutrients on the sauce matrix were investigated. It was proven that plant extracts (grape seeds, green tea, echinacea) provoke astringency and bitterness due to the high content of polyphenols, and prebiotics significantly transform rheological indicators, acting as fat imitators. Mineral complexes most often cause a metallic aftertaste and catalyze lipid oxidation. An algorithm for the formation and preparation of an expert commission in accordance with ISO and DSTU standards (in particular ISO 6658, DSTU ISO 8586, ISO 13299) was developed. The procedure for selecting candidates by sensitivity thresholds, methods for their training using physical standards and periodic calibration of the tasting panel to eliminate "sensory drift" is described. A unified terminology for constructing petal diagrams is substantiated. The assessment of the reliability, reproducibility and consistency of the expert panel is implemented through mathematical and statistical tools, in particular multivariate analysis of variance (ANOVA), Kendall's concordance coefficient and the principal component method (PCA), which allows for recording objective "digital fingerprints" of the sensory space. The feasibility of using three types of model systems (emulsion two-phase systems "oil-water", acid-aggressive tomato bases and highly destructive fruit and berry matrices) is scientifically verified. This allowed for a comprehensive study of the phenomena of synergism and antagonism of ingredients and to model the optimal "harmony coefficient" of finished products, combining their high biological value with impeccable gastronomic characteristics.

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