Abstract. To assess the competitiveness of products abroad, the method of descriptor-profile analysis is widely used, the essence of which is that the complex concept of one of the organoleptic properties (taste, smell, texture) is in the form of a set of simple components (descriptors) that are evaluated by tasters intensity on the appropriate scale. The method allows comparing the sensory characteristics of the products produced with competitors and developing the sensory profiles of the original standards (brands) of products. The article presents the results of scoring the quality of nine samples of apple juice. As a result of the work carried out by the commission of appraisers of taste, fruit juice descriptors were developed. Based on the marketing research, consumer preferences were studied and the coefficients of significance of fruit juice descriptors were determined. Further, a 50-point scale for evaluating the quality of fruit juices based on the received descriptors was developed. Using the developed point scale, the quality of nine samples of reconstituted apple juice was assessed, as a result of which a sample of apple juice was determined, which scored the maximum number of points and approached the profile of an ideal apple juice. Currently abroad profile method of tasting analysis is used: for a comprehensive assessment of the quality of the food; to regulate vinification processes in accordance with the desired flavor profile of wines (USA); assessment of the quality of complex products (chocolate, coffee, tea, sauces); when developing new products by companies such as Nestle, Pepsico, Coca-Cola, RC Cola, Sweppes, McDonalds, etc; when developing and evaluating the flavor profile of flavors by companies such asIFF (France), Quest (Netherlands), Dohler (Germany), Frutarom (Israel), Sargill (USA); in the preparation of defectological charts of food products; when training tasters; when monitoring the stability of the organoleptic characteristics of the food product. The proposed descriptor-profile method has great prospects in organoleptic analysis due to its flexibility and the ability to adapt it to solve various tasks of a production or research nature.

Keywords: apple juice, descriptor-profile analysis method, evaluators, descriptors, significance coefficients, quality rating scale.

Analysis of recent research and publications

Sensory analysis – analysis using sensory organs (highly specific receptor organs), which provide the body with information about the environment through vision, hearing, smell, taste, touch, vestibular reception and interception [2].

All methods of sensory assessment are divided into two large classes: analytical and consumer. Analytical methods include three types of methods: distinctive, descriptive, and methods using scales and categories. To conduct an analytical assessment, testers must meet the requirements for selected testers. For such a tasting commission, sensory evaluation by analytical methods usually does not cause difficulties, and the results obtained are, as a rule, quite reliable and reproducible [3].

If a distinction is required between test products,
distinctive sensory assessment methods are used. If you need to identify and evaluate the sensory characteristics of a product, a descriptive analysis is performed. The task of the testers, in this case, is to determine what sensory characteristics (attributes) are present in the product and what is their intensity. In analytical tests, tasters should leave personal addictions and hedonic reactions aside [4].

It should be noted that the creation of competitor product profiles is closely related to the possibility of identifying directions for adjusting sensory properties, improving products and positioning them in the consumer market.

Assessment of competitiveness by the profile method includes the development of a dictionary of sensory product characteristics, specialized questionnaires for testing and the implementation of a tasting project. After that, the analysis of the obtained data is carried out, including the verification of reliability by statistical methods, the construction of sensory profiles of product samples and the preparation of recommendations for adjusting sensory properties [5, 6].

Another area of use of profile descriptor analysis is the development of profiles of the organoleptic properties of reference products, which may be interesting for enterprises in terms of assessing the stability of the organoleptic characteristics of the product, and therefore the high demand for it, as well as the prospects for reaching additional consumer segments of these products or entering new markets. In order to create the profile of the reference product, the company selects the most promising, original, highly sought-after sample, for which sensory characteristics are developed to describe its personality. Then carry out an assessment of the intensity of the selected characteristics. Based on the data obtained, a profile of the reference product is built. Subsequent actions in relation to the received standard are to trace its configuration (profile) for a certain time on the basis of monitoring data conducted by the tasting commission. At the same time, it is important to collect and analyze data regularly (online) [7].

The advantage of the profile method is that the complex concept of one of the organoleptic properties (taste, smell or texture) is represented as a combination of simple components (descriptors), which are evaluated by tasters in terms of quality, intensity and order of appearance [8].

To build a sensory profile, special selection and training of tasters is carried out. In this case, individuals are selected who are able to decompose the general impression of the quality of the studied product into its constituent features and quantify them. It is proved that 10% of tasters cannot carry out sensory assessment by the profile method. Profile analysis involves thorough knowledge by tasters of product properties and good sensory memory for its individual characteristics [9, 10].

The quantitative descriptor-profile method allows you to solve many problems of the food manufacturer in the field of organoleptic analysis, and in the first place: a comprehensive assessment of the quality of food products, including products with a complex flavor profile; development of new customer-oriented products, as well as rebranding of existing products; control of production processes, storage and transportation; study of consumer preferences and acceptability; a comprehensive assessment of the advantages and disadvantages of organoleptic parameters in comparison with competing products; training participants in organoleptic tests [11].

The purpose of this work is to assess the quality of samples of reconstituted apple juice based on developed descriptors. To achieve this goal it is necessary to solve a number of problems:

- to study the assortment of fruit juices in the market of the Republic of Belarus;
- select selected fruit juice evaluators;
- compile a panel of descriptors of fruit juice;
- draw up a questionnaire for consumers;
- conduct a marketing research of consumer preferences when buying fruit juice;
- determine the significance coefficients of descriptors based on market research;
- make a taste-aromatic portrait of the perfect apple juice;
- develop a grading scale for evaluating apple juice based on compiled descriptors and certain significance factors;
- to assess the quality of samples of apple juice based on the developed point quality assessment.

With a detailed study of the descriptor-profile method of food research, both domestic and foreign special literature was studied. In scientific articles Lisitsina A.B. “An integrated approach to organoleptic evaluation as a tool to improve product quality”, N. Zavorokhina “The use of the descriptor-profile method of tasting analysis in a comparative assessment of the quality of cheese”, N. Merkulova “Determination of product taste”, Semenova EA. “Instrumental sensory methods for assessing the quality of canned fish”, A. Llishevtseva “Control of the quality characteristics of juice products”, “Food adequacy of vegetable juices”, L. Melnikova “Modern approaches to assessing the sensory quality of fermented vegetable and fruit products”, K. Nachay “Raise a Glass to Innovative Fruit and Vegetable Beverages”, “Taking a Fresh Look at Fruits and Vegetables”, “Fruits and Vegetables Move to the Forefront”, D. Despain “Fruit-Focused Formulating”, Neil H. Mermeinstein “Preventing Juice Spoilage” reflects the main features of sensory analysis, organoleptic assessment of food quality, instrumental methods of food research are considered, attention is paid to the quality problems of raw materials, finished products, the processes that occur during food storage products affecting the quality of the goods, as well as existing domestic and foreign modern tasting methods for researching food products are analyzed.

### Research materials and methods

During the research, organoleptic, measuring, calculated, descriptor-profile research methods were used.
To establish a number of descriptors, the head of the group of appraisers suggested that testers taste three samples of fruit juice recovered in a volume of 1 liter of different manufacturers. Data on manufacturers of fruit juices are presented in table 1 [12-14].

Initially, the task was to develop descriptors of fruit juices, on the basis of which the quality of samples of apple juice will be evaluated in the future.

Testers were selected to develop fruit juice descriptors. According to ISO 11035, taking into account individual discrepancies, the minimum number of testers in a group should be at least six [8].

As experts, 6 expert commodity experts in food products graduated from the Belarusian State University of Economics with a degree in Commodity Science and Expertise of Goods.

During the tasting, the testers formulated their perceptions of fruit juice samples using descriptors. Further, 104 descriptors formulated by the testers were grouped into the following categories: appearance, smell, taste, texture. Descriptors developed during the tasting process are shown in Table 2.

Further, during the discussion, a group of testers reduced hedonic terms, quantitative terms, terms with the name of the product in their names, as well as irrelevant terms. The terms that are considered unsuitable for the description of products and the establishment of differences between them in terms of organoleptic analysis have also been reduced. The results of the descriptor reduction are shown in table 3.

To further reduce the list of terms (descriptors), you need to make sure that the testers have a good understanding of the meaning of each of the descriptors. Testers at this stage received three samples of fruit juice, and then they need to determine the perceived severity for each of the descriptors used, assigning it a rating on a scale from 0 to 5, stipulating that 0 is equivalent to the lack of perception of the property in question [8].

The severity scale for descriptor reduction is shown in table 4.
To conduct an organoleptic assessment of the quality of apple juices, nine samples of apple juice manufactured by various manufacturers were selected. Based on the classification of descriptors obtained, ten leading descriptors were finally selected.

The list of selected descriptors is shown in Table 8.

Using marketing research, the significance for consumers of each descriptor for fruit juices developed by a group of evaluators was determined [16]. The results of the study are shown in Table 9.

For the obtained 10 descriptors of fruit juice, a 50-point scale for assessing the quality of fruit juices was developed. For each descriptor, a quality gradation of 1 to 5 points was established. Thus, the best sample of fruit juice in its quality assessment can get a maximum number of points – 50.

The results of the developed point scale for assessing the quality of fruit juices based on the selected descriptors are shown in Table 10.

The developed grading scale for evaluating fruit juices based on selected descriptors will make it possible to conduct an organoleptic assessment of the quality of apple juice samples in the future.

To conduct an organoleptic assessment of the quality of apple juices, nine samples of apple juice recovered in a volume of 1 liter of various producers were selected. Data on the producers of apple juices are presented in Table 11.

Table 3 – Abbreviated List of Descriptors

| Appearance | Smell | Taste | Consistency |
|------------|-------|-------|-------------|
| familiar   | fragrant | bitterness | liquid      |
| attractive | invigorating | sourness | tender       |
| transparent | natural aroma | the presence of sweets | homogeneous |
| light coloured | distinct | refreshing | uniform     |
| bright color | pleasant aftertaste | juicy | richness of taste |

Table 4 – Scale of expression

| Descriptor | Not perceived | Weak | Pretty weak | Average | Pretty strong | Strong |
|------------|---------------|------|-------------|---------|---------------|--------|
|            | 0             | 1    | 2           | 3       | 4             | 5      |

In order to reduce the number of descriptors at this stage, they are first classified in accordance with the geometric mean M, which is the square root of the product of frequency F, and the relative severity of I, each descriptor:

\[ M = \sqrt{F \times I} \]  

Where \( F \) – is the number of references to the descriptor in relation to the total number of possible references to this descriptor, expressed as a percentage;

\( I \) – is the sum of the severity assigned by the entire group to the descriptor with respect to the maximum possible severity for the given descriptor, presented as a percentage.

The total number of times each descriptor is mentioned is 18 (three products x six evaluators). Table 5 shows the frequency of reference for each descriptor.

The total possible degree of expression for each descriptor is 90 (a maximum of five on the scale of expression for three products with six evaluators = 3x3x3). Table 6 shows the relative severity of each descriptor. The next stage of the study was the classification of descriptors according to their importance. The results are shown in Table 7.
### Table 6 – Relative severity of each descriptor

| Product | Descriptors | No 1 | No 2 | No 3 | PCED* |
|---------|-------------|------|------|------|-------|
| No 1    | Familiar    | 17   | 18   | 16   | 51    |
|         | Attractive  | 24   | 22   | 25   | 71    |
|         | Transparent | 28   | 27   | 28   | 83    |
|         | Light-colored | 11  | 12   | 16   | 30    |
|         | Bright color | 10   | 10   | 9    | 31    |
|         | Fragrant    | 28   | 25   | 26   | 46    |
|         | Invigorating | 15   | 14   | 17   | 81    |
|         | Natural aroma | 30  | 25   | 24   | 79    |
|         | Distinct    | 10   | 8    | 6    | 24    |
|         | Bitterness  | 20   | 18   | 19   | 56    |
|         | Sourness    | 25   | 26   | 28   | 27    |
|         | The presence of sweets | 30 | 23   | 21   | 27    |
|         | Refreshing  | 25   | 23   | 21   | 21    |
|         | Pleasant aftertaste | 29 | 25   | 26   | 26    |
|         | Juicy       | 10   | 13   | 14   | 14    |
|         | Richness of taste | 9   | 8    | 7    | 69    |
|         | Liquid      | 8    | 9    | 17   | 80    |
|         | Tender      | 5    | 12   | 15   | 37    |
|         | Homogeneous | 12   | 8    | 19   | 11    |
|         | Uniform     | 30   | 10   | 19   | 10    |

* Perceived severity of each descriptor

### Table 7 – Classification of descriptors by their importance

| Parameter | Descriptors | I (%) | F (%) | M (%) | As a percentage | Descriptor classification |
|-----------|-------------|-------|-------|-------|-----------------|--------------------------|
| Familiar  | 39.7        | 0.278 | 0.567 | 0.397 | 15              | 39.7                     |
| Attractive | 66.2        | 0.556 | 0.789 | 0.662 | 11              | 66.2                     |
| Transparent | 92.2       | 0.833 | 0.922 | 0.922 | 4               | 92.2                     |
| Bright colour | 33.3      | 0.333 | 0.333 | 0.333 | 18              | 33.3                     |
| Natural aroma | 51.1     | 0.511 | 0.076 | 0.076 | 7               | 51.1                     |
| Bitterness | 83.3        | 0.333 | 0.076 | 0.076 | 7               | 83.3                     |
| The presence of sweets | 91.6  | 0.916 | 0.091 | 0.091 | 19              | 91.6                     |
| Refreshing | 77.2        | 0.772 | 0.077 | 0.077 | 12              | 77.2                     |
| Pleasant aftertaste | 45.3    | 0.453 | 0.045 | 0.045 | 19              | 45.3                     |
| Juicy     | 88.9        | 0.889 | 0.089 | 0.089 | 16              | 88.9                     |
| Richness of taste | 40.0      | 0.400 | 0.040 | 0.040 | 19              | 40.0                     |
| Liquid    | 64.4        | 0.644 | 0.064 | 0.064 | 10              | 64.4                     |
| Tender    | 17.1        | 0.171 | 0.017 | 0.017 | 17              | 17.1                     |
| Homogeneous | 56.7       | 0.567 | 0.057 | 0.057 | 17              | 56.7                     |
| Uniform   | 33.3        | 0.333 | 0.033 | 0.033 | 17              | 33.3                     |

### Table 8 – Designed fruit juice descriptors

| Appearance | Smell | Taste | Consistency |
|------------|-------|-------|-------------|
| transparent | fragrant | the presence of sweets | homogeneous |
| natural aroma | sourness | refreshing | |
|                |                | pleasant aftertaste | |
|                |                | richness of taste | |

### Table 9 – The coefficients of significance for each descriptor

| Appearance | Relevance | Smell | Relevance | Taste | Relevance | Consistency | Relevance |
|------------|-----------|------|-----------|-------|-----------|-------------|-----------|
| transparent | 0.05      | fragrant | 0.10      | bitterness | 0.05    | homogeneous | 0.10      |
| natural aroma | 0.15    | sourness | 0.05      | presence of sweets | 0.10    |               |            |
|                |                |                | refreshing | 0.05 |           |             |           |
|                |                |                | pleasant aftertaste | 0.15 |               |             |           |
|                |                |                | richness of taste | 0.20 |               |             |           |
Table 10 – Point scale for assessing the quality of fruit juices

| Level of quality        | Excellent                                      | Good                                         | Satisfactory                           | Unsatisfactory                        |
|-------------------------|------------------------------------------------|----------------------------------------------|----------------------------------------|----------------------------------------|
| Transparency            | Corresponds to the fruit characteristic of the  | The same, but without shine (4)              | Weak opalescence (3)                   | Precipitation possible (2)             |
|                         | drink; glitter color (5)                        |                                              |                                        |                                        |
| Fragrant smell          | Full, pronounced (5)                            | Pleasant Aroma (4)                           | Mild flavor (3)                        | Unnatural Aroma (2)                    |
| Natural aroma           | Peculiar to the fruits of which juice is made (5)| Recognizable fruit aroma from which juice   | The unrecognized aroma of fruit from    | The presence of chemical notes in the  |
|                         |                                                | is made (4)                                  | which juice is made (3)                | aroma of juice (2)                     |
| Bitterness              | Moderate, not expressed (5)                     | Expressed (4)                                | Strongly Expressed (3)                 | Highly expressed, interfering with the |
|                         |                                                |                                              |                                        | perception of the taste of the drink   |
| Soursness               | Moderate, not expressed (5)                     | Expressed (4)                                | Strongly Expressed (3)                 | Highly expressed, interfering with the |
|                         |                                                |                                              |                                        | perception of the taste of the drink   |
| The presence of sweets  | Moderate, severe (5)                            | Moderate, unexpressed (4)                    | Mild, almost not felt (3)              | Lack of sweets (2)                     |
| Refreshing taste        | Pronounced refreshing sensations (5)            | Pronounced refreshing sensations (4)         | Unexpressed refreshing sensations (3)  | Not refreshing (2)                     |
| Pleasant aftertaste     | Pleasant aftertaste (5)                         | Pronounced pleasant aftertaste (4)           | Unexpressed pleasant aftertaste (3)    | Lack of pleasant aftertaste (2)        |
| Richness of taste       | Brightly Flavored (5)                           | Saturated taste (4)                          | Taste poorly saturated (3)             | Taste desaturated (2)                  |
| Homogeneous consistency | Without inclusions, suspensions, the same      | Without inclusions, suspensions, but        | Weak consistency (3)                   | The presence of inclusions, suspensions, sediment (2) |
|                         | density of juice                                | different density of juice in the whole      |                                        |                                        |
|                         |                                                | product (4)                                  |                                        |                                        |
| Total point             | 41–50                                          | 31–40                                        | 21–30                                  | 20                                     |

Table 11 – Objects of experimental research

| Sample No | Name of Apple Juice                                                                 | Manufacturer                                                                 |
|-----------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| Sample No 1 | Apple juice «Sochnyi» clarified, reconstituted, pasteurized and aseptically packed | JLLC “Oasis Group”, 213823, Republic of Belarus, Mogilev region, Bobruisk, st. Nakhimova, 1 |
| Sample No 2 | Apple juice «Dobryi» clarified, restored, pasteurized                               | UE “Vlanpak”, Republic of Belarus, Minsk region, Smolevichi, st. Vokzalnaya, 5B |
| Sample No 3 | Apple juice «ABC» clarified reconstituted sterilized, aseptically packed            | ODO “ABC Firm”, 230026, Republic of Belarus, Grodno, st. Pobedy, 27          |
| Sample No 4 | Apple juice «JAFFA» clarified reconstituted pasteurized                            | JV “Vitmark-Ukraine”, 65007, Ukraine, Odessa, st. Vysokii, 22                |
| Sample No 5 | Apple juice «Sandy Priadonia» clarified reconstituted, sterilized and aseptically packed | LLC “Lebedyanский”, 399610, Russian Federation, Lipetsk Region, Lebedyan, st. Matrosova, 7 |
| Sample No 6 | Apple juice «Sady Pridonia» clarified restored, pasteurized                        | OJSC “Sady Pridonia”, 403027, Russian Federation, Volgograd Region, Gorodishchensky District, Sad Pridonia |
| Sample No 7 | Apple juice «Rich» clarified reconstituted pasteurized                             | JSC "Multon", 192236, St. Petersburg, st. Sofiyskaya, 14                    |
| Sample No 8 | Apple juice No. 1» reconstituted, clarified, sterilized and aseptically packed      | LLC “Leto Trade”, 220028, Republic of Belarus, Minsk, st. Mayakovskiy, 127, bldg. 2, room 104 |
| Sample No 9 | Apple juice «Soki Ukrainy» reconstituted, clarified, pasteurized                   | LLC "ECO-SPHERE", 22400, Ukraine, Vinnytsia region, Kalinovka, st. I. Mazepa, 45 |
To assess the quality, 9 samples of recovered apple juice were selected, of which 4 samples were produced in the Republic of Belarus and 5 imported samples from the Russian Federation and Ukraine. All types of apple juice are clarified. 6 samples of the presented products were pasteurized, and the remaining 3 samples ("No. 1", "Sandora", "ABC") were sterilized. Samples numbered 1, 3, 5, 8 (apple juices of the brands “Juicy”, “ABC”, “Sandora”, “No 1”) are aseptically packed.

**Research results**

This article presents the results of an organoleptic assessment of the quality of apple juice samples using the profile-descriptor method.

During the study, we evaluated the appearance, taste, aroma and consistency of 9 samples of apple juice, based on the developed ten descriptors. The evaluation results are shown in table 12.

| Name/ Descriptor | Transparent appearance | Fragrant smell | Natural aroma | Bitterness | Sourness | The presence of sweetness | Refreshing taste | Pleasant aftertaste | Richness of taste | Homogeneous consistency | Total |
|------------------|------------------------|----------------|---------------|------------|----------|--------------------------|----------------|------------------|----------------|------------------------|-------|
| The perfect apple juice sample | 4 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 0.05 | 0.05 | 5 |
| Sokatyi | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 0.05 | 0.05 | 4 |
| Dobryi | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |
| ABC | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |
| JAFFA | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |
| Sandora | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |
| Sady Prudom | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |
| №1 RICH | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |
| Sok/Ukr | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0.05 | 0.05 | 4 |

Table 12 – Point scale for assessing the quality of 9 samples of apple juice
Conclusions

As a result of the scoring of the quality of 9 samples of apple juice, it was established that the highest number of points was scored by apple juice “RICH” (4.8 points), and the lowest points (4.1 points) were scored by “JAFFA”, “Sandy”, and “Sady Pridonia”. According to the “Transparent appearance” descriptor, the maximum number of points was gained by juices of the brands “Sochnyi”, “Dobryi”, “ABC” and “RICH”. The juices of “Sochnyi”, “Sandy”, and “RICH” brands have the most “Fragrant smell”. The maximum number of points on the handle “Natural aroma” scored juice brand “Dobryi”. The maximum number of points on the descriptor “Bitterness” did not score a single apple juice. 5 points for the “Sourness” descriptor scored apple juices of the brands “Sochnyi” and “RICH”.

All samples of apple juice, except for juices of “Sandy” and “Sady Pridonia”, scored 5 points for the “Presence of Sweets” descriptor. The most “Refreshing taste” are apple juices of the brands “ABC”, “Sandy”, “Sady Pridonia”, “RICH”. The maximum number of points on the handle “Pleasant aftertaste” scored juices of the brands “JAFFA” and “RICH”. All samples of apple juice have a rich taste and on the descriptor ” Richness of taste” scored 5 and 4.

Thus, using the developed descriptors and weighting coefficients, an assessment was made of the quality of apple juice samples, as a result of which the best sample of apple juice was determined - apple juice “RICH” (4.8 points).

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(France), Quest (Netherlands), Doehler (Israel), Frutarom (Israel), Cargill (USA); at the composition of the defectological cards of the food product; at training of tasters; at control of stability of the organoleptic characteristics of the food product. Proposed descriptive-professional method has great perspectives in organoleptic analysis thanks to flexibility and can be adapted to solve different issues of productive or research character. In the article, the results of the numerical assessment of the quality of nine samples of apple juice were presented. During this work, the commission of tasters-assessors developed descriptors of fruit juices. Based on the market research study, consumer preferences and determined coefficients of significance of descriptors for fruit juice. Then, 50-balance scale of quality assessment of fruit juices was developed on the basis of achieved descriptors. Using the developed balance scale, the quality of nine samples of reconstituted apple juice was assessed, as a result, the sample of apple juice which gathered the maximum number of points and approached the profile of ideal apple juice.

Keywords: apple juice, descriptive-professional analysis method, tasters-assessors, descriptors, coefficients of significance, quality assessment scale.

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