

Study of the influence of vegetable powders on the quality indicators of pasta

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Abstract. A rapid development of areas related to the manufacturing of products of increased nutritional value has captured almost all countries of the world. Pasta is one of the most popular food products and is included in the list of everyday products that are in great demand among the population, in this regard, there is an excellent opportunity to reduce the lack of vitamins in a large part of the population by adding non-traditional raw materials to pasta. The authors set a goal to investigate the effect of vegetable powders on the quality indicators of pasta, for which an original recipe for pasta with the addition of carrot powder was developed. The enterprise “Kostanayskyi melkombinat” JSC was chosen as the base for the study. Determination of organoleptic quality indicators of pasta was carried out according to generally accepted methods, on a five-point scale. Physical and chemical indicators were determined according to the method set forth in the regulatory and technical documentation; two qualitative indicators were taken as a basis: the mass fraction of moisture and acidity. Thus, a recipe for a new type of pasta enriched with vegetable powder was developed and the quality indicators of the finished product were evaluated.

1 Introduction

In recent years, all countries of the world have been actively developing the direction for the production of food products with increased nutritional value. Pasta is one of the most popular food products in high demand among the population. In this regard, there is an excellent opportunity to reduce the lack of vitamins in a large part of the population by adding non-traditional raw materials to pasta.

Vegetables contain a large number of vitamins and minerals in their composition. According to the World Health Organization, a person should consume at least 400g of vegetables daily [1]. That is why the enrichment of pasta with vegetable additives is of

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particular interest. The most convenient and optimal option is to use vegetable powders as vegetable additives.

Vegetable powder is a semifinished product rich in biologically active substances. Vegetable powder is widely used in the food industry. It is used in the production of dietary and baby food, in the production of juices, muesli, cosmetics, and in the production of dietary supplements [2].

There is a huge variety of vegetable powders depending on the raw materials produced: tomato, pumpkin, cabbage, carrot, etc.

Vegetable powders do not contain artificial ingredients, dyes and flavors. This is a 100% natural product. It consists only of dried fresh fruits and vegetables. The technology for creating such a powder is quite simple. Its essence lies in the drying of fruits and vegetables, followed by their grinding. Powder prepared in this way has a shelf life of 3-4 months. With the right production technology, vegetable powder after drying and grinding retains 95-97% of all nutrients (vitamins, acids, biologically active substances, micro- and macroelements, etc.) from fresh vegetables [3].

Also, due to the conformity of technology, the color, taste and aroma characteristic of fresh vegetables are preserved. That is, the composition of the vegetable powder is almost the same as the vegetables from which this powder was produced.

The use of vegetable powder as an additive will allow to get pasta with certain functional properties. However, before introducing the production technology of a new range of products, special attention must be paid to the influence of non-traditional raw materials on the quality of the finished product.

The purpose of the work is to investigate the effect of vegetable powders on the quality indicators of pasta.

Research tasks:

- to analyze the effect of vegetable powder on the organoleptic characteristics of pasta;
- to investigate the effect of vegetable powder on the main physical and chemical indicators.

The object for the study was samples of pasta with the addition of vegetable powder (by weight of flour) in the amount of 5, 10 and 15%, prepared under the conditions of the enterprise "Kostanayski melkombinat" JSC.

The subject of the study is the effect of vegetable powder on the quality indicators of pasta.

2 Literature review

The influence of vegetable additives on the quality of pasta was studied by authors from near and far abroad.

Sobota, A. & Wirkijowska, A. & Zarzycki, P. in their studies used beet and carrot concentrates, as well as powders of these vegetables to increase the nutritional value of pasta. They established a positive trend in increasing the content of minerals and fibers. To develop the recipe, they replaced 0.2%, 4.6% and 8% wheat flour with vegetable additives [4].

Fazullina O.F., Smirnov S.O. studied the effect of broccoli and celery powder, they found that the introduction of these herbal supplements increases the nutritional value of pasta [5].

Stephen Sule, Abu Joseph Oneh, Igyor Michael Agba used carrot powder in the amount of 5, 10, 15, 20, 25 and 30%, adding it to wheat flour and then assessing the quality of the resulting wheat-carrot pasta. They found that the most optimal additive for the production of wheat-carrot pasta is 25% [6].

D. Mridula, R. K. Gupta, Harjot Khaira, Sheetal Bhadwal conducted research on the impact of using carrot juice in the food production process. They found that the digestibility of pasta increases and antioxidant activity increases [7].

Yadav, D.N., Sharma, M., Chikara, N. Considered the effect of barley millet with vegetable powders on the quality of dough and finished pasta, as a result of which they found that the addition of vegetable powders enriches the mineral composition, as well as increases the content of proteins and carbohydrates. As an additive, 2% of vegetable powders from the total mass of the wheat-pearl mixture was used [8].

Vimercati W.C., Macedo L.L. and da Silva Araújo C. studied the effect of spinach on the quality of pasta, during their studies they found that the addition of an additive did not significantly affect the quality of finished products [9].

Kaur, N., Aggarwal, P., Kaur, N. researchers studied the effect of bell pepper on the quality of finished products with the addition of additives in the amount of 5%, 10% and 15%. They found that the most optimal is an additive in the amount of 10% of the total mass of raw materials. The introduction of bell pepper increased the fiber content in the finished product [10].

3 Methodology

One of the most popular vegetable powders, carrot powder, was used as an additive. For its manufacture, fresh carrots were taken, cut into small pieces and dried in a special dryer for vegetables at low temperatures (75 °C) until the moisture completely evaporated from the raw material (6-7 hours).

The dried pieces of carrots were crushed in a laboratory mill brand LZM to a homogeneous powder state. The resulting carrot powder has a juicy orange color with a pleasant taste and smell characteristic of carrots. This powder is a 100% natural product obtained from fresh fruits, without the addition of additives, flavors and dyes.

For the manufacture of samples, flour from soft vitreous wheat was used and part of it was replaced with vegetable powder in the required amount for each sample. Before adding carrot powder to a mixture of flour and water, it must be mixed with water until a creamy consistency is obtained. Part of the water from the total is used to dissolve the carrot powder. And subsequently mixed with flour and the remaining amount of water [11].

The organoleptic evaluation of pasta quality was carried out in the laboratory of the university. The assessment includes the determination of the color of the samples, taste, smell, as well as appearance. All of the above indicators are determined using the senses and compared with the standard (sample No. 1). 31964-2012 "Pasta. Acceptance rules and methods for determining quality" state standard was used as the basis for organoleptic evaluation. Each indicator is evaluated on a 5-point scale [12].

The color of pasta must be even, without dark, white spots and traces of unmixed flour. Color shades of finished products differ depending on the one used. The determination is carried out in natural light for better color perception, for this the test samples are laid out on a white sheet of paper, since the difference in shades between the samples is better visible on a white background. In conclusion, a score is given from 0 to 5.

To determine the smell, a sample of the test sample with a mass of 20 g is taken, carefully crushed, then poured into a glass and poured with water, the temperature of which should be on average $60\pm 5^{\circ}\text{C}$, mixed and left to settle for 1-2 minutes. At the end of time, the water is poured out and the smell is determined. Taste is determined by chewing a sample of the test sample weighing 1 gram.

The shape must correspond to the selected type of pasta to be produced. The shape must be correct, without distortions and bends. A strong difference in the length and thickness of the products is unacceptable.

The main physical and chemical quality indicators characteristic of pasta include: humidity and acidity.

To determine the physicochemical parameters, several parallel weights (5.00 + 0.01) were taken; After the drying time, the bottles are removed from the oven, cooled in a desiccator until completely cooled, but not more than 2 hours, and weighed. According to the state standard, the moisture content of pasta should not exceed 13%.

Determination of acidity was carried out according to the state standard. A sample of the same mass is placed in a flask with 30–40 cm³ of distilled water previously poured into them. Five drops of a 1% phenolphthalein solution are added to the resulting suspension and titrated with sodium hydroxide solution until a pink color appears, which does not disappear within 1 min.

According to the state standard, the acidity of pasta should not exceed 4°T. In pasta with the addition of tomato products, the acidity should be no more than 10°T, with milk or soy additives no more than 0.2°T [13].

4 Empirical findings

Samples of pasta were made and studied on the basis of the laboratory of "Kostanayskyi melkombinat" JSC. Flour from soft vitreous wheat, drinking water and carrot powder were used as raw materials. The formulation is presented below in table 1.

Table 1. Recipe for pasta with carrot powder.

Raw material	Dosage 5%	Dosage 10%	Dosage 15%
Flour, g	950	900	850
Drinking water, g	300	300	300
Carrot powder, g	50	100	150
Total, g	1300	1300	1300

The presented samples (figure 1) were studied for the influence of quality indicators of pasta.

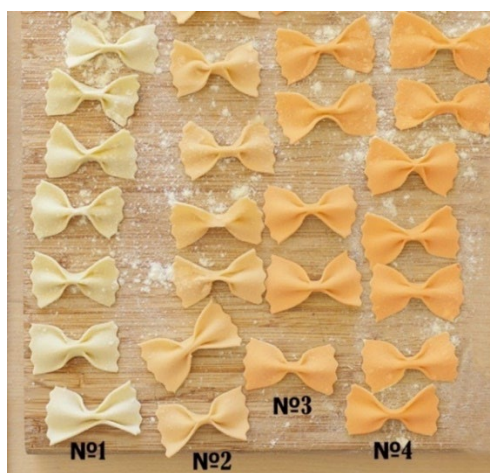


Fig. 1. Samples of pasta

No. 1 - control sample of pasta without the addition of vegetable powder;

No. 2 - a sample of pasta with the addition of 5% carrot powder by weight of flour;

No. 3 - a sample of pasta with the addition of 10% carrot powder by weight of flour;

No. 4 - a sample of pasta with the addition of 15% carrot powder by weight of flour.

The results of the organoleptic evaluation are shown in figure 2.

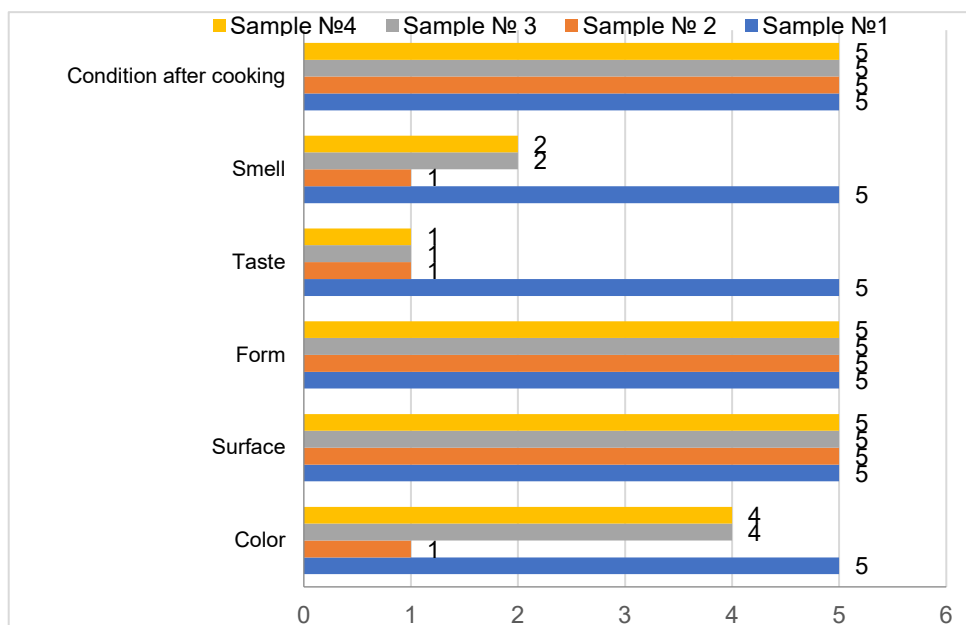


Fig. 2. Organoleptic indicators.

The color of sample #2 with the addition of 5% carrot powder is very pale, and practically does not differ from sample #1, so it received the lowest score for this indicator. Samples No. 3 and No. 4 received 4 points each, the color is already more pronounced. The samples acquired a slightly pronounced orange color characteristic of fresh carrots. One point was removed for the reason that if we compare these samples with pasta sold on store shelves, then their color is not so bright and saturated. As a result, the color saturation depends on the amount of vegetable powder, the greater the percentage of addition, the brighter the color of the finished products.

Dried pasta had a fairly smooth surface and regular shape, so all samples received the maximum score.

The taste did not differ from traditional pasta. As a result, all samples with the addition of carrot powder received the lowest possible scores. Sample No.3 and No.4 have a slightly carroty smell, unlike sample No.2. For this indicator, sample No. 3 and No. 4 received 2 points each, and sample No. 2 received 1 point out of 5.

After cooking, all samples received the maximum score. After cooking, all samples retained their shape well and evenly increased in size.

According to the results of organoleptic analysis, sample No. 1 prepared without the addition of carrot powder received the maximum score of 5 out of 5. Samples No. 3 and No. 4 received the same number of points 3.7. And the minimum score (3 points) was received by sample No. 2.

The following results of physicochemical analysis were obtained.

- The results of the study of the mass fraction of moisture in pasta samples are shown in figure 3.

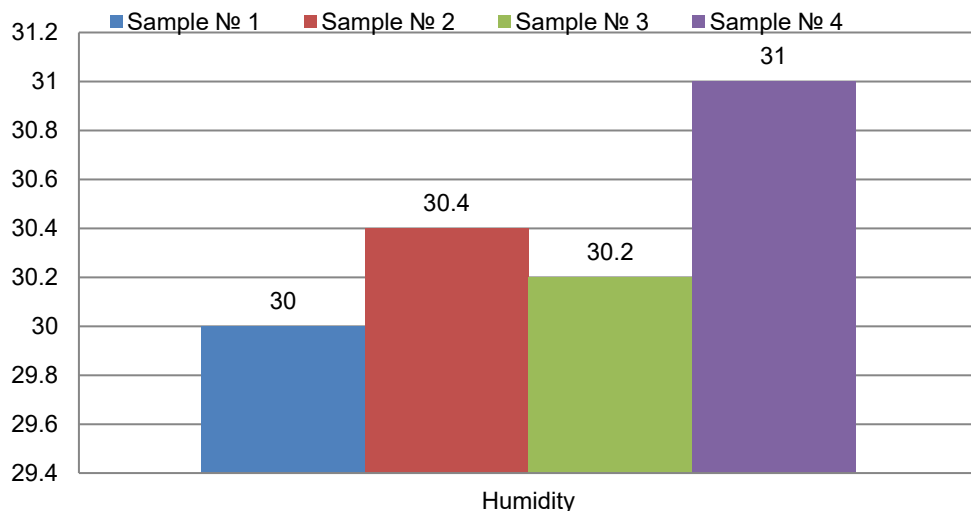


Fig. 3. Moisture analysis results.

According to the state standard, the moisture content of finished pasta should not exceed 13%. But it is worth noting that these pasta products have not been dried, which means they are semi-finished pasta products or, in other words, raw pasta. In traditional pasta, selected after the matrix, the moisture content should be 30-31%. Humidity of sample No. 1 is 30%, sample No. 2 - 30.4%, sample No. 3 - 30.2%, sample No. 4 - 31%.

Based on the results of the analysis, it can be concluded that the replacement of wheat flour with vegetable powder in the amount of 5, 10 and 15% does not affect the content of the mass fraction of moisture in finished products. The difference in the obtained moisture results between samples No. 1 and No. 2 is 0.4%, and between samples No. 2 and No. 3 does not exceed 0.2%. The greatest difference is observed between samples No. 1 and No. 4 - 1%. This speaks to the undulating effect of the addition of carrot powder on moisture. But, despite this, all the results of the samples do not go beyond the permissible values.

- The results of the study of acidity in pasta samples are presented in figure 4.

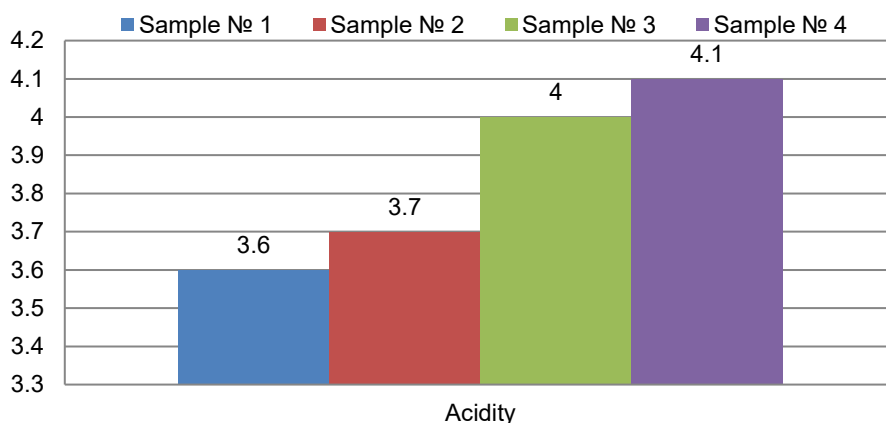


Fig. 4. Acidity analysis results.

Sample No. 1 has the lowest acidity of 3.6°T without the addition of carrot powder. In sample No. 2 with the addition of 5% vegetable powder, the acidity is 3.7°T. In sample No. 3, the acidity is 4°T, and in sample No. 3, it is 4.1°T. The acidity of samples prepared

according to the traditional recipe and with the addition of vegetable powder, the nominal value according to the state standard should not exceed 4°T. An increase in the amount of vegetable powder from the mass of flour leads to an increase in acidity in the finished product. Excess acidity is unacceptable, so sample No. 4 does not meet the quality requirements.

5 Conclusion

In the course of the studies of the quality indicators of pasta with the addition of carrot powder, it turned out that with the addition of 5% carrot powder, the color of the finished products is pale, there is no taste; a large addition of carrot powder increases and exceeds the allowable acidity for pasta, which is unacceptable. The optimal percentage of adding vegetable powder is 10% by weight of flour. These pasta have a pleasant appearance and have an increased nutritional value and digestibility.

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