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THE USE OF DRIED APPLES IN THE PRODUCTION OF YEAST ROLLS®

Zastosowanie suszu jabłkowego w produkcji bułek drożdżowych®

Keywords: dried apples, yeast rolls, baking industry.

Bread can be considered the most frequently consumed food product that is present in the daily diet of almost every consumer. In this study, yeast rolls were prepared, in the composition of which sugar was partially or completely replaced by dried apples. Along with the increase in the addition of dried apples, an increase in the antioxidant potential was shown, which was confirmed by a higher total polyphenol content and a higher activity against DPPH radicals. The highest scores in the sensory assessment were given to rolls of standard composition. The best, among the samples with modified composition, were rolls with 75% sugar replaced with apple dry.

Słowa kluczowe: susz jabłkowy, bułki drożdżowe, przemysł piekarski.

Pieczywo można uznać za najczęściej spożywany produkt spożywczy, który jest obecny w codziennej diecie niemal każdego konsumenta. W niniejszym badaniu przygotowano bułki drożdżowe, w składzie których cukier częściowo lub całkowicie zastąpiono suszem jabłkowym. Wraz ze zwiększeniem dodatku suszu jabłkowego wykazano wzrost potencjału przeciwutleniającego, potwierdzonego wyższą zawartością polifenoli ogółem oraz wyższą aktywnością wobec rodników DPPH. Najwyższe noty w ocenie sensorycznej przyznano bułkom o standardowym składzie. Najlepiej, spośród próbek o modyfikowanym składzie, oceniono bułki, w składzie których 75% cukru zastąpiono suszem jabłkowym.

INTRODUCTION

Bread is one of the basic and indispensable groups of products that is most often found in the everyday diet of humans [1]. Bread play a vital role in ensuring your daily energy intake. It is also a source of carbohydrates, protein, vitamins, mainly from group B, and minerals, including potassium, iron, calcium, and phosphorus. The quality of bread is shaped in the technological process and depends to a large extent on the raw materials used to obtain them [4]. The importance of eating bread may be demonstrated by placing cereal products in the food pyramid. Prof. dr hab. n. med. Mirosław Jarosz, interpreting the pyramid as the third principle of proper nutrition and lifestyle, indicated the consumption of cereal products, especially whole grains [5]. In the average Polish food ration, cereal products, which are dominated by bread, provide the most carbohydrates from all food groups (about 60% of the supply in the diet). The nutritional value of bread is determined by the content of protein, fats, carbohydrates, minerals, vitamins and depends, among others, on on the used flour and flavor additives [17, 3]. The average monthly consumption of bread is about 3 kilograms per person - data from 2019 and 2.75 kg – data from 2020 [6].

The contemporary customer is very aware of his choices, which are based on the analysis of the raw material composition, pro-health values, as well as the search for producers who produce in the spirit of modernity and care for the environment [12]. These factors contribute to significant changes in the bakery market. Bakeries introduce new products to meet the needs of customers, but also to stand out from the competition not only with quality and freshness, but also with a variety of assortment and health benefits.

The high potential of ingredients contained in dried fruit is used to increase the nutritional value of products, as well as to make the offer more attractive on the foodstuff market [8]. Moreover, producers strive to reduce or eliminate sugar from the composition of food products, for which the properties of dried fruit can be used. Especially products constituting the basis of the daily diet, such as bread, should contain ingredients that have a beneficial effect on the health of consumers [13].

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The aim of this study was to develop a technology for obtaining confectionery bread with the addition of dried fruit and to analyze the antioxidant properties expressed in the total polyphenol content and antiradical activity against stable DPPH and sensory evaluation on the example of yeast rolls.

METHODOLOGY

The first stage of this research was the development of the technology for obtaining yeast rolls. The raw material composition, parameters of the dough production process and baking parameters were determined. The raw materials for the production of yeast rolls were: type 550 wheat flour, white crystal sugar, water, fresh baker's yeast, margarine, iodized food salt, dried apples, fresh hen eggs. Six modifications to the recipe composition were prepared. The basic composition was flour, water, sugar, margarine, yeast and salt. Sugar was partially or completely replaced with dried apples (3 variants). An attempt was also made to partially replace the flour with dried apples (2 variants). The recipe composition of the prepared yeast rolls is shown in Table 1.

Technological methods

Dried apples were obtained from apples of the Golden delicious variety, which were successively pre-processed: washing, removing the seed nests and cutting into slices 0.5 cm thick in the Coupe CL 50 Robot. The drying process was carried out at the temperature of 65° C for 7 hoursin a convection dryer. After cooling down, the dried fruit was ground in a Vorwerk Terrmomix TM6 device. Grinding parameters - turbo program in 5 times 2 seconds mode.

The dough was prepared by kneading all the ingredients in a MANKIEWICZ model SP-800A planetary mixer. The yeast was liquefied in water in a ratio of 1: 2. The margarine was dissolved by heating it on an electric heating plate. The weighed and prepared ingredients were dispensed into the bowl and mixed for 2 minutes at low speed (132 rpm) followed by 7 minutes at medium speed (234 rpm). The kneaded dough was left to rise at 30° C ± 1° C for 60 minutes. After this time, the dough was kneaded (pierced) for 1 minute at slow speed (132 rpm). Then, billets weighing 50 g were weighed in a Divider Rounder DR Robot Automatic DAUB Bakery Machinery divider-rounder at a height of 3.5; revolutions 5.0 and pressure 4.5. The billets were placed on the sheets and subjected to subsequent proofing for 40 minutes at the temperature of 30°C ± 1°C. After about 20 minutes, the billets were smeared with the beaten egg. The rolls were baked at 180° C for 18 minutes.

Analytical methods

Total polyphenol content determination

The content of polyphenols was determined by the Folin Ciocialteu method for acetone extracts. The extracts were prepared by pouring 20 g of roll crumb into 200 ml of an aqueous acetone solution (70%) and then shaking for 60 minutes. The extracts were then filtered through a fluted filter. In order to convert the content of total polyphenols, a standard curve for gallic acid was prepared. An aliquot of 50 mg of gallic acid was dissolved in 70% acetone solution (extraction solution) in a 50 cm 3 volumetric flask, making up to the mark with the extraction solution. Then 0, 25, 50, 75 and 100 µl of gallic acid solution (in duplicate) were collected in the test tubes successively and each tube was supplemented with the extraction solution to the volume of 300 µl. To each test tube was added: 4.15 ml of deionized water, 500 µl of 20% sodium carbonate solution, 50 µl of Folina-Ciocialteu reagent. A blank sample was prepared. After 20 minutes, the absorbance at 700 nm was measured in a Shimadzu UVmini-1240 spectrophotometer. On the basis of the obtained results, dependencies of the absorption of the solution on the amount of gallic acid contained in it were graphically plotted.

Total polyphenol content was determined on proper samples containing 300 µl of extract, 4.15 ml of deionized water, 500 µl of 20% sodium carbonate solution, 50 µl of Folin-Ciocialteu reagent. A blank test was prepared in parallel. After 20 minutes, the absorbance was measured on a Shimadzu UVmini-1240 spectrophotometer at a wavelength of 700 nm. Based on the standard curve, the total polyphenol content was calculated and expressed as gallic acid equivalents per 100 g of product. The determination was performed in four parallel replications.

Table 1. Raw material composition of yeast rolls

Tabela 1. Skład surowcowy bułek drożdżowych

raw materials	variant 0 basic composition	variant I sugar:dry 50%:50%	variant II sugar:dry 25%:75%	variant III sugar:dry 0%:100%	variant IV flour: dry 75%:25% sugar:dry 100%:0%	variant V flour: dry 75%:25% sugar:dry 0%:100%
mass of raw materials [g]						
flour	1000,0	1000,0	1000,0	1000,0	750,0	750,0
water	450,0	450,0	450,0	450,0	450,0	450,0
sugar	150,0	75,0	37,5	0,0	150,0	0,0
margarine	100,0	100,0	100,0	100,0	100,0	100,0
yeast	60,0	60,0	60,0	60,0	60,0	60,0
salt	10,0	10,0	10,0	10,0	10,0	10,0
apple drought	0,0	75,0	112,5	150,0	250,0	400,0

Source: The own study

Źródło: Badania własne

Determination of antioxidant activity

Extracts prepared for the determination of total polyphenols were used to determine the ability of extracts to deactivate stable DPPH radicals. The DPPH solution was prepared by weighing out 19.7 mg of radicals, which were transferred to a 100 cm^3 volumetric flask and made up to the mark with methanol. The control sample contained 4 cm3 of 70% acetone and 1 cm^3 of the DPPH radical solution. The proper sample contained 100 µl of extract, 3.9 cm^3 of 70% acetone and 1 cm^3 of DPPH radical solution. Blank test: 100 µl of extract, 3.9 cm^3 of 70% acetone, 1 cm^3 of methanol. The samples were mixed and, 30 minutes after the addition of DPPH radicals, the absorbance was measured in a Shimadzu UVmini-1240 spectrophotometer at a wavelength of 517 nm. The antiradical activity of the extracts against DPPH radicals was calculated according to the following formula:

$$A = \frac{A_K - (A_{wł} - A_{śl})}{A_K \cdot 100} \quad (1)$$

where: A – antiradical activity against DPPH radicals (%)
A_K – control sample absorbance
$A_{wł}$ – absorbance of the sample proper
$A_{śl}$ – absorbance of the blank

Sensory analysis

The subject of the sensory evaluation were six types of yeast rolls with different amounts of dried apple in their raw material composition. The sensory evaluation by a group of twenty people was carried out according to specific quality parameters such as: the color of the crust, the thickness of the crust, the color of the crumb, the porosity of the crumb, the smell and the taste. The discriminants were characterized and assigned appropriate weighting factors (Table 2).The results of sensory tests were determined on a five-point scale:

5 – quality extremely desirable
4 – desirable quality
3 – quality somewhat desirable (tolerated)
2 – undesirable quality
1 – defective product

RESULTS AND DISCUSSION

Total polyphenol content

The antioxidant potential expressed in the total content of polyphenols was determined in the prepared yeast rolls. The content of the determined parameter was also analyzed in dried apples, determining the total content of polyphenols at the level of 163.55 mg of gallic acid in 100 grams of the product. In the analyzed samples of rolls, the content of polyphenols was determined at the level of 54.23–749.19 mg gallic acid in 100 g of product (Fig. 1). The increase in the addition of dried apples, as expected, increased the content of total polyphenols. The lowest content of polyphenols was determined in rolls with a standard composition of 54.23 mg of gallic acid / 100 g of product, and the highest – 749.19 mg of gallic acid in 100 g of the product - in rolls with the highest addition of dried apples - variant V (Table 1). With a low content of dried apples, in variants I and II the total poly-phenols content was below 100 mg. Variant III contained 150 g of dried apples, and the determined content of total polyphenols was almost six

Table 2. Characteristics of quality markers

Tabela 2. Charakterystyka wyrożników jakościowych

attribute	weighting factor	points				
		5	4	3	2	1
the color of the rind	0,2	golden to brown, even	slightly darker or lighter, even	darker or lighter, slightly uneven	too dark or too light, uneven	brown to black, very light, gray
the thickness of the rind	0,1	even, medium thick	medium thick	a bit too thick or a bit too thin	too thick or too thin, uneven	very thick
the color of the crumb	0,15	perfectly even, natural	aligned	a bit too dark or too light, different in terms of zones	clearly different from the natural, very light or very dark	brown, gray, lack of alignment
the porosity of the crumb	0,1	evenly distributed and very well developed pores of the same size	evenly distributed and well-developed pores of similar size	pores unevenly spaced, quite different in size	pores unevenly spaced, very varied or absent	no pores or large empty holes
flavor	0,2	very pleasant	pleasant	not very expressive	weak with a slight foreign smell	unpleasant, foreign (e.g. mold, yeast)
taste	0,25	very pleasant, aromatic	pleasant, aromatic	not clear, too sweet or not sweet enough, slightly sour	strongly acidic, excessively sweet or not sweet enough	stranger

Source: The own study

Źródło: Badania własne

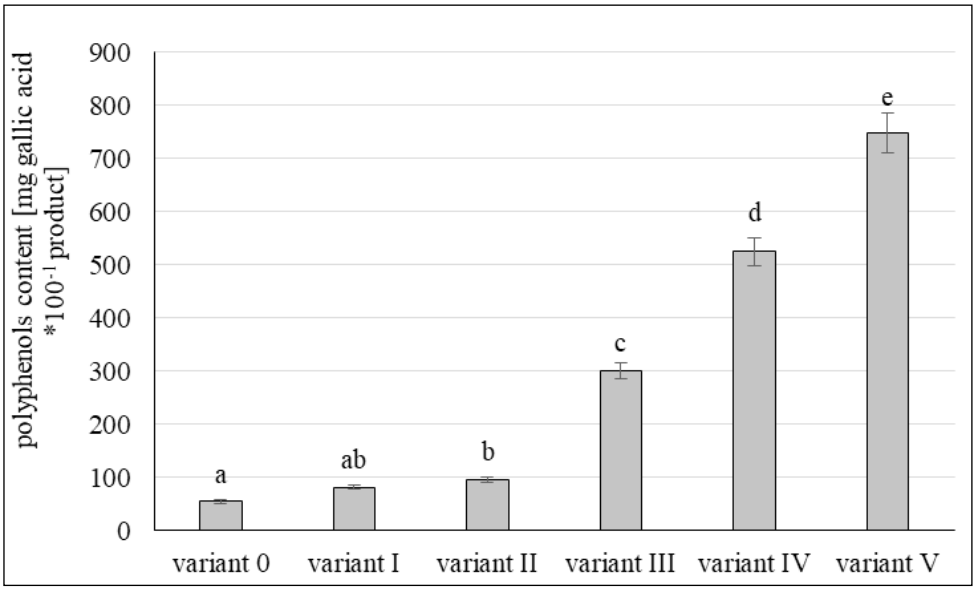

Fig. 1. Total polyphenols content in the analyzed yeast rolls (sample markings used – Table 1).

Rys. 1. Zawartość polifenoli ogółem w analizowanych bułkach drożdżowych (zastosowane oznaczenia próbek – Tabela 1).

Source: The own study

Źródło: Badania własne

times higher than in the samples with the basic composition and over three times higher than in the rolls of variants I and II. The determined content of polyphenols resulted both from the amount of the determined parameter in basic raw materials (variant 0) and from the potential of a given dried apple.

Reis et al. [11] confirmed the beneficial effect of the addition of dried apple pomace to extruded and baked rolls. Dried apple pomace was also used in the studies by Sudha et al. [14]. They showed a beneficial effect and an increase in the content of phenolic compounds with an increased addition of pomace. They determined the optimal addition of pistons in rolls at 15%, in muffins – 30%, and in cookies – 20%. The highest levels of total polyphenols were found in extruded products with 30% added pomace.

Antiradical activity against stable DPPH radicals

The antioxidant activity expressed against stable DPPH radicals was determined in the range from 25.81% to 46.7%. The lowest antioxidant activity was shown by rolls with the basic composition and with 50% addition of dried apples instead of sugar (Fig. 2). Statistical analysis confirmed that there were no significant differences between these samples. Similarly, the antiradical activity of rolls with the composition defined as variants II and III was at a similar level, which was confirmed by statistical inference (Fig. 2). The correlation analysis showed a strong correlation between the total polyphenol content and the anti-radical activity at the level of 0.9693.

The highest activity was determined for samples composed of the V variant, which were also characterized by the highest total polyphenol content. Nakov et al. [9] obtained similar results to those obtained in this study. Increasing the addition of dried apple peel increased the content of total polyphenols, as well as increased antiradical activity. The correlation between the content of polyphenols and their ability to scavenge free radicals was confirmed. The relationship was similar to that shown in the current study. The differences in the defined anti-radical activity were significantly lower compared to the determined total polyphenol content in the same samples. Thermal treatment may affect the composition of the polyphenols and the antioxidant capacity of the products. Low humidity and high temperature (about 200°C) favor the conversion of quercetin into other compounds), while thermal treatment facilitates the release of phenolic acids from cell walls and improves their bioavailability [18].

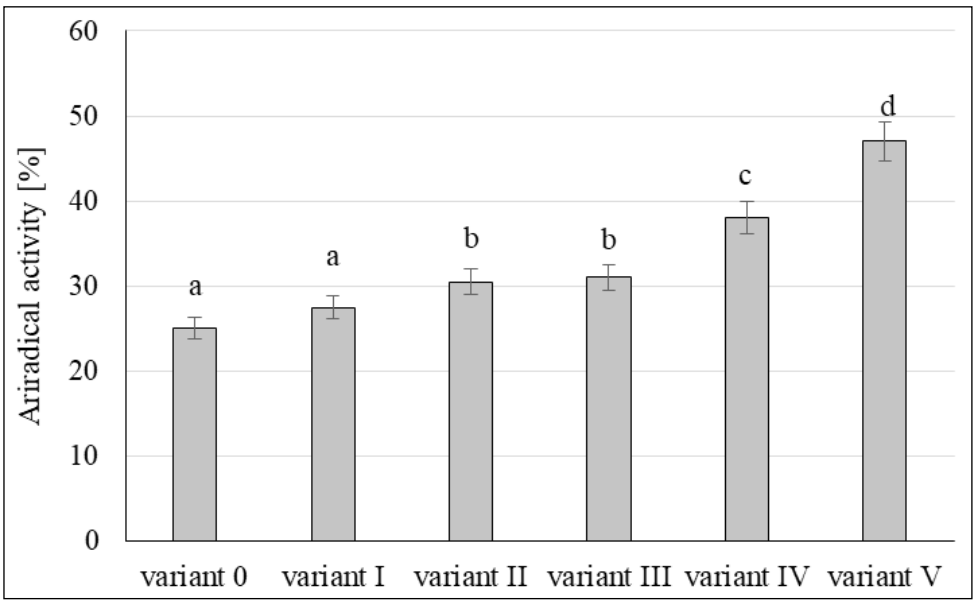

Fig. 2. Antiradical activity against stable DPPH radicals (sample markings used – Table 1).

Rys. 2. Aktywność przeciwutleniająca wobec stabilnych rodników DPPH (zastosowane oznaczenia próbek – Tabela 1).

Source: The own study

Źródło: Badania własne

Sensory analysis

Sensory analysis is one of the tools used to evaluate new products [10]. The yeast rolls were assessed for six discriminants (Table 2). The awarded scores were averaged and multiplied by the weighting factor. The color of rolls with a standard composition was assessed the highest (0.9). On the other hand, the lowest scores were given to variant III, which did not contain sucrose (Fig. 3). The team members indicated that the lower scores resulted from the too light color of the crust of the analyzed rolls. the color of the skins of yeast rolls resulted In their research, Jannati et al. [7] also obtained a lower evaluation of the skin color for bread to which apple pomace was added. In contrast, Tańska and Rotkiewicz [16] recorded higher scores for samples with the addition of pomace. The peel thickness was assessed in the range of 0.36–0.45 points (Fig. 3). The highest score was given to the rolls with the basic composition (variant 0), while the lowest score was given to the skin of rolls from variant IV. The remaining variants of rolls obtained a similar score (0.41–0.42), and the thickness of the crust was assessed as moderately thick and even. For this discriminant, Tańska and Rotkiewicz [16] again obtained opposite relationships than in the current research – higher scores compared to the control sample were obtained by bread with the addition of apple pomace.

The color of the crumb was significantly dependent on the amount of dried apples added. The apples were dried with the skin, which was visible as darker particles in the crumb. The crumb of basic rolls was rated the highest (0.68). On the other hand, the lowest score was given to rolls, in the composition of which 25% of flour was replaced with apple dry (variant IV). The team members indicated that the rolls in which part of the sucrose and / or flour had been replaced with dried material had a distinctly different color than the natural ones. Similar dependencies were shown in their studies by Sudha et al. [15]. Bread with the addition of expeller scored lower than the samples without their addition. On the other hand, Tańska and Rotkiewicz [16] obtained scores opposite to that of Sudha et al. [15] and the current analyzes. Low scores were awarded to crumb porosity (0.3–0.42) (Fig. 3). The lowest scores were given to rolls in which part of the flour was replaced with dried apples. The porosity of the remaining rolls was similarly rated, with a score of 0.4–0.42. The evaluators described the pores in the crumb as well-developed and even, while for the low-rated samples as unevenly distributed and diversified in terms of size. Tańska and Rotkiewicz [16] for the samples with a 10% addition of bagasse showed no differences in the assessment of porosity, which was confirmed by the results obtained for the samples with the modification of sugar itself, in which the dry content was 8–15% in relation to the amount of flour. On the other hand, Sudha et al. [15] noticed that a 30% addition of bagasse in bread resulted in lower porosity scores, which is confirmed by the results obtained in this study. The most aromatic for the evaluators turned out to be rolls, in which 75% of sugar was replaced with dried apples (0.94) (option II). On the other hand, the least pleasant to smell was bread with the highest dry content (0.66) (variant III). All other samples were assessed within the limits of 0.69–0.77. Tańska and Rotkiewicz [16] and Jannati et al. [7] noted a significant increase in the scores for the smell of bread with apple pomace compared to the control sample. The last distinguishing feature was flavor. The panelists liked the rolls with the basic composition and variant III - the composition of which sucrose was completely replaced with dried apples (Fig. 3). The lower taste ratings were explained by the panelists with too low sweetness, which may also be the result of habit. Tańska and Rotkiewicz [16], as well as Jannati et al. [7], who obtained higher scores in their research for bread with apple pomace, were again different. In order to summarize the sensory evaluation, the results of the mean

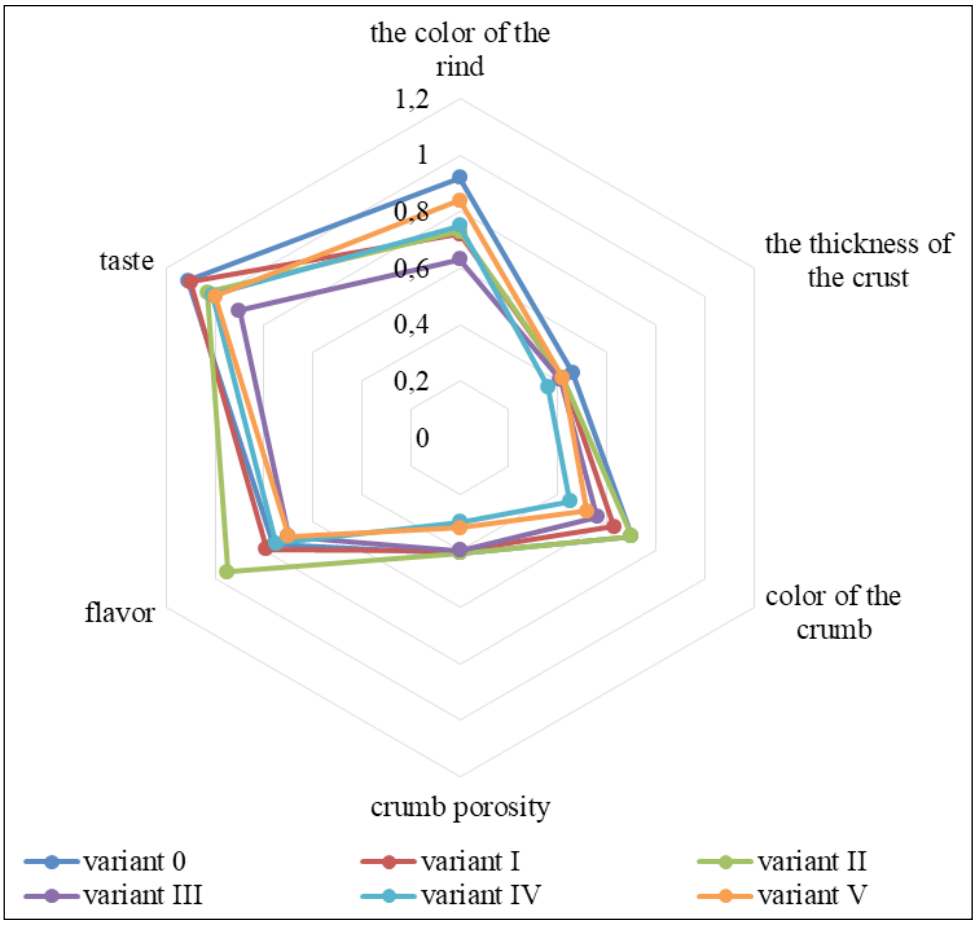

Fig. 3. Sensory evaluation of the analyzed yeast rolls (sample markings used – Table 1).

Rys. 3. Ocena sensoryczna analizowanych bułek drożdżowych (zastosowane oznaczenia próbek – Tabela 1).

Source: The own study

Źródło: Badania własne

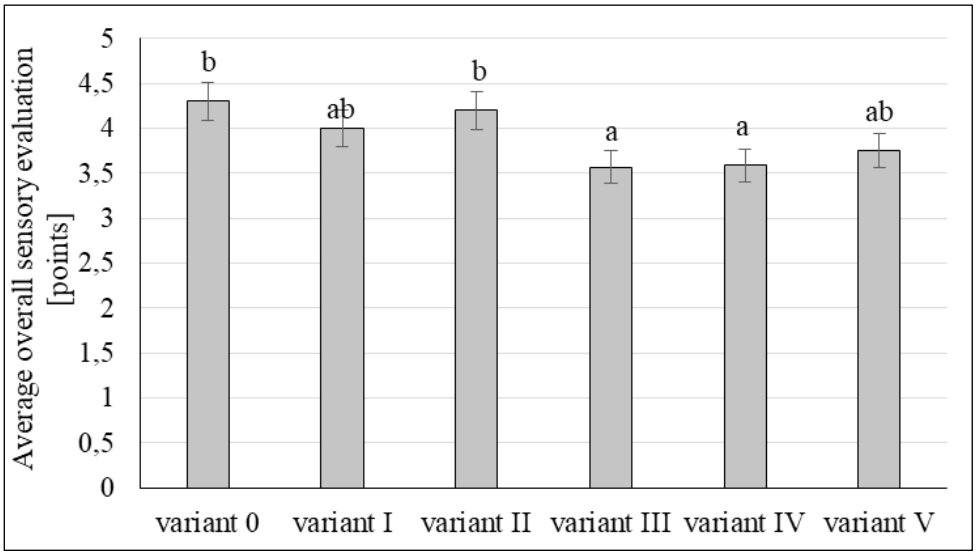

Fig. 4. Average overall sensory evaluation of the analyzed yeast rolls (sample markings used – Table 1).

Rys. 4. Średnia ogólna ocena sensoryczna analizowanych bułeczek drożdżowych (zastosowane oznaczenia próbek – Tabela 1).

Source: The own study

Źródło: Badania własne

overall evaluation of the analyzed yeast rolls were summarized (Fig. 4). The lowest overall score was awarded to rolls in the composition of which sucrose was completely replaced with dried apples (variant III) and in samples where 25% of flour was replaced with dried apples (variant IV). The highest grades were rolls with basic composition (variant 0) and rolls with 75% of sucrose replaced with dried apples (variant III). Baca et al. [2] and Jannati et al. [7] also found that a high level of added fiber or apple pomace significantly reduced the acceptability of the bread, which was mainly manifested in a darker color and bitter taste. The first of the mentioned authors considered the addition of fiber to be acceptable, while Jannati et al. [7] – only up to 3% of apple pomace.

CONCLUSIONS

Bread is one of the basic products in the daily diet. Its quality is influenced by: the raw materials used for production, the method of keeping the dough and the duration of fermentation. The use of dried apple as a raw material, which is a natural source of bioactive compounds, allows to increase the bioactive potential of yeast rolls. It is confirmed by the results of the determined content of total polyphenols and the anti-radical activity of the analyzed samples. From a nutritional point of view, it is preferable to use dried apples as a sucrose replacement ingredient. It is also important that the potential consumer accepts the new product. In the sensory evaluation, the panelists rated the rolls with a high content of dried apples lower in terms of color, crumb porosity and smell. The best grades were rolls with the basic composition and those with 75% sugar replaced with dried fruit. This indicates the sensory acceptability of rolls with the addition of dried apples, but at the same time containing sugar. This may result from consumer habits and indicates the need for research to optimize the composition of yeast rolls.

WNIOSKI

Pieczywo jest jednym z podstawowych produktów występującym w codziennej diecie. Na jego jakość mają wpływ: surowce użyte do produkcji, metoda prowadzenia ciasta oraz czas trwania fermentacji. Zastosowanie jako surowca suszu jabłkowego, będącego naturalnym źródłem związków bioaktywnych, pozwala na zwiększenie potencjału bioaktywnego bułek drożdżowych. Potwierdzeniem są wyniki oznaczonej zawartości polifenoli ogółem oraz aktywności przeciwrodnikowej analizowanych próbek. Korzystne, z żywieniowego punktu widzenia, jest zastosowanie suszu jabłkowego jako składnika zastępującego sacharozę. Istotne jest także zaakceptowanie nowego produktu przez potencjalnego konsumenta. W ocenie sensorycznej, paneliści niżej ocenili bułki z wysoką zawartością suszu jabłkowego pod względem barwy i porowatości miękiszu oraz zapachu. Najlepiej zostały ocenione bułki o składzie podstawowym oraz te, w składzie których 75% cukru zastąpiono suszem owocowym. Wskazuje to na akceptowalność sensoryczną bułek z dodatkiem suszu jabłkowego, ale zawierających jednocześnie w składzie cukier. Może to wynikać z przyzwyczajeń konsumenckich i wskazuje na konieczność badań w kierunku optymalizacji składu bułek drożdżowych.

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