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THE USEFULNESS OF FERMENTED KOMBUCHA TEA FOR THE PRODUCTION OF LOW-ALCOHOLIC DRINKS

S u m m a r y

Background. Consumers' growing interest in fermented food contributes to the development of the market in functional drinks, which are rich in biologically active compounds that positively affect the human body. One of such drinks is the fermented Kombucha tea, appreciated for its taste and beneficial health properties. The study aimed to select suitable yeast starter culture for the production of fermented low-alcohol beverages based on Kombucha having good microbiological and sensory quality and high antioxidant activity. The scope of the research included developing a technological process for the Kombucha tea drink with the addition of wine, brewing and probiotic yeast, and subsequently, determining the quality of the designed drinks. The research methodology included the analysis of pH value, alcohol content, microbiological analysis, antioxidant activity, total polyphenol content and a sensory analysis.

Result and conclusion. Based on the research conducted, it was found that obtaining low-alcohol fermented beverages based on Kombucha is possible, and the quality of these products depended on the yeast starter cultures. They significantly impacted all the tested parameters of the final products. The low-alcohol drinks obtained were characterized by a low level of alcohol and a high content of antioxidant compounds, as well as the desired microbiological and sensory quality. The results obtained are a pilot for further research into the usefulness of fermented Kombucha tea for the production of low-alcohol beverages.

Key words: Kombucha, yeast starter cultures, low-alcohol fermented beverages, antioxidant activity, polyphenols

Introduction

Kombucha, a fermented tea drink, is gaining more and more interest among consumers due to its sensory and health-promoting properties [3]. The raw material for the production of Kombucha is green and black tea with added sugar. These ingredients are the basis for starting a fermentation process with a symbiotic starter culture -

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SCOBY (Symbiotic Culture of Bacteria and Yeast). SCOBY includes acetic acid bacteria (AAB), yeast and lactic acid bacteria (LAB). As a result of the properly conducted fermentation process, the Kombucha drink acquires the characteristic features of a refreshing, slightly sweet and slightly sour product [15]. Kombucha is a source of bioactive compounds such as organic acids, minerals, vitamins, polyphenols and antioxidant compounds [30]. The glucuronic acid (GlcUA) contained in the drink increases the bioavailability of polyphenols [15] that participate in the prevention of chronic noncommunicable diseases and affect the composition of the intestinal microbiome [27]. The chemical composition of Kombucha has high antioxidant potential that reduces the occurrence of oxidative stress [27]. The consumption of functional fermented beverages can positively affect the human body [22].

Non-alcoholic or low-alcohol drinks, such as beer or wine, are becoming more and more popular and can replace other alcoholic products. According to the current guidelines, an alcoholic beverage is a product intended for consumption containing ethyl alcohol of agricultural origin in a concentration exceeding 0.5 % alcohol by volume. On the other hand, a low-alcohol beverage is a product with an alcohol content by volume not exceeding 1.2 %. However, beer contains about 5 % alcohol on average. There is a lack of sufficient legal regulations on this topic, and classifying these products as typically alcoholic beverages causes several legal doubts, especially regarding their naming and labelling [11, 19]. Fermented tea drink Kombucha produced in industrial conditions according to a fixed and repeatable recipe may contain 0.5 % alcohol [29]. Due to the ethanol content in their composition, the described drinks are not intended for all consumer groups, e.g. small children or pregnant women. This topic needs more research to determine precise possibilities and limitations of consumption of this beverage for the aforementioned consumer groups.

Starter cultures for food production are defined as preparations of live and safe microorganisms that are used for the fermentation process [17]. In recent years, there has been a trend in food microbiology to study microorganisms with different activity properties in starter cultures [13]. Nowadays, consumers interested in a healthy lifestyle expect the brewing industry to provide healthier alternatives to mass products [28]. Therefore, the proposal of Kombucha as a raw material base with selected yeast starter cultures for low-alcohol beverages is a promising solution.

The study aimed to select a yeast starter culture for fermented low-alcohol beverages based on Kombucha of good microbiological and sensory quality and high antioxidant activity.

Materials and methods

The material for the study was Kombucha prepared from raw materials such as Sencha green tea (Eat K. Augustowicz, Poland), sucrose (Diamant, Anabru, Poland),

brewing and wine yeast (Tab. 1) and the SCOBY-SGGW starter culture (collection of the Department of Hygiene and Food Quality Management, Warsaw University of Life Sciences). SCOBY-SGGW is cultivated continuously according to Neffe-Skocińska et al. [22], and the medium is replaced with a new one every 10 days [21]. SCOBY-SGGW was created from the spontaneous fermentation of infusion of mixed black and green tea with sugar.

The study included six variants of low-alcohol beverages produced in the Kombucha fermentation process with wine, brewing and probiotic yeasts. The characteristics of starter cultures and the designations of the research samples are presented in Table 1.

Table 1. Classification of tested yeast strains
Tabela 1. Klasyfikacja badanych szczepów drożdży

Sample / Próbka	Species of yeast starter culture / Gatunek kultury startowej drożdży	Sample characteristics / Charakterystyka próbki	Year of purchase / Rok zakupu
K	-	Control sample/ Próbka kontrolna - Kombucha	-
S.b.	Probiotic yeast / Drożdże probiotyczne *Saccharomyces cerevisiae var. boulardii*	*Saccharomyces boulardii* CNCM I-745 (Enterol, Biocodex, Gentilly, France/ Francja)	2021
M12	Brewer's yeast / Drożdże piwowarskie *Saccharomyces cerevisiae*	Mangrove Jack's Kveik M12 (Mangrove Jack's, Auckland, New Zealand/ Nowa Zelandia)	2021
M21		Mangrove Jack's Belgian Wit M21 (Mangrove Jack's, Auckland, New Zealand/ Nowa Zelandia)	2021
M29		Mangrove Jack's French Saison M29 (Mangrove Jack's, Auckland, New Zealand/ Nowa Zelandia)	2021
M44		Mangrove Jack's US West Coast M44 (Mangrove Jack's, Auckland, New Zealand/ Nowa Zelandia)	2021
CK S102	Wine yeast / Drożdże winiarskie *Saccharomyces cerevisiae*	CK S102 LeMag (LeMag, Żyrardów, Poland / Polska)	2021

The technological process of preparing low-alcohol beverages consisted of three stages (Figure 1). In the first stage of the experiment, the Kombucha was prepared for further research. Tap water, Sencha leaf green tea (Eat K. Augustowicz sp. j., Poland) (8 g/1,000 cm^3), sucrose (70 g/1,000 cm^3) and SCOBY-SGGW starter culture (50 g/1,000 cm^3) were used. Water having a temperature of 90 ℃ was poured over tea leaves and sucrose, and brewed for 10 minutes. The infusion was separated from the tea leaves and cooled to 25 ℃. The infusion obtained was inoculated with SCOBY starter culture. The fermentation was carried out for 6 days at 25 ℃ in laboratory conditions. The second stage was to carry out the fermentation process of the drink ob-

tained using strains of yeast. The yeast was activated from a bank of pure cultures (-80 ℃) on YGC agar medium at 25 ℃ for 3 days (Millipore, Poland). One colony of each yeast strain was transferred to a sterile malt extract solution (5 g malt extract/100 g H_2O, NeoGen, Poland) to propagate the yeast to 6 log CFU/ mL. Before adding yeast to Kombucha, the malt extract was centrifuged and replaced with a Kombucha drink. The initial number of added yeast in the Kombucha was 6 log CFU/ cm^3. Conical flasks with stoppers and fermentation tubes were used to ferment the beverages. The third stage of the process was maturing of beverages to obtain the final products at 8 °C for 4 months and limited access to light.

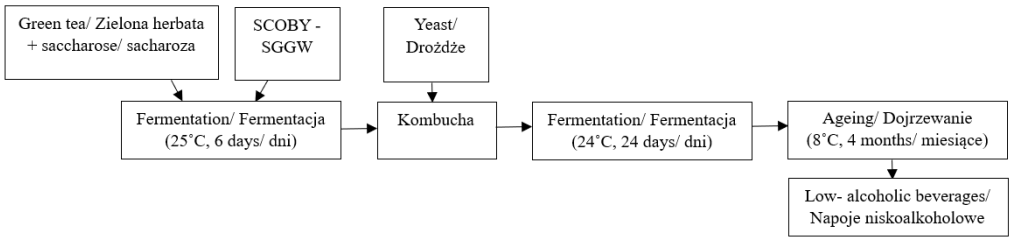

Fig. 1. Scheme of the technological process of the low-alcoholic beverages obtained
Rys. 1. Schemat procesu technologicznego uzyskanych napojów niskoalkoholowych

pH value

The analysis was determined by measuring the pH of the beverage using a pH meter (Orion Star™ A211; Thermo Fisher Scientific, Poland) according to the device manual.

Alcohol content

The alcohol content was determined by the calculation method according to the Balling formula (Equation 1). °Blg measurements were made using a hydrometer (Alla; France). The initial extract of the Kombucha beverage before fermentation and after the maturation process was measured.

$$E = \frac{100 \times A \times 2.006 + Er}{100 + A \times 1.066}$$

Equation 1. Balling's formula
Równanie 2. Wzór Ballinga
Explanatory notes / Objaśnienia: E – basic wort extract in % by weight; A – alcohol concentration in % by weight; Er – actual extract in the finished drink in % by weight; 2.066 - relationship between the extract and alcohol, 1 g of alcohol is made from 2.066 g of the extract; 1.066 – loss of extract during fermentation per one gram of alcohol produced / E – ekstrakt brzeczki podstawowej w % wagowo; A – stężenie alkoholu w % wagowo; Er – ekstrakt rzeczywisty w gotowym napoju w % wagowo; 2,066 – zależność między

ekstraktem a alkoholem, 1 g alkoholu powstaje z 2,066 g ekstraktu; 1,066 – ubytek ekstraktu w trakcie fermentacji przypadający na jeden wytworzony gram alkoholu

Microbiological analysis

The enumeration of AAB bacteria and yeast was performed by plate inoculation method. After the maturation process, 1 mL samples were taken from the beverages. Serial dilutions were performed in sterile peptone water (Millipore; Poland). The inoculation was made on Petri dishes with GCA medium for AAB prepared according to the recipe of Neffe-Skocińska et al. [21] and on YGC medium (Millipore, Poland) intended for yeast cultivation. Incubation was carried out for 72 hours at 25 ℃. The results are expressed as the logarithm of the colony-forming units per milliliter of products (log CFU/ mL).

Antioxidant activity

Antioxidant activity was measured by the method according to Re et al. (1999) with modification. $ABTS^{\bullet+}$ radicals (2,2'-azobis(3-ethylbenzothiazoline-6-sulfonate) (Sigma-Aldrich, Poznań, Poland). $ABTS^{\bullet+}$ was prepared 24 hours before the assay by mixing inactive ABTS radicals (7 mM/dm^3) with $K_2S_2O_8$ (2.45 mM/dm^3) (Sigma-Aldrich, Poznań, Poland) and stored at room temperature for 24 hours [23]. Immediately before assay $ABTS^{\bullet+}$, the solution was diluted with PBS to an absorbance of 0.7 ± 0.02. 50 µl of each tested sample and 150 µl of the $ABTS^{\bullet+}$ radical solution were poured into a well of a 96-well polystyrene plate with a volume of 1 well of 300 µl. The radical scavenging reaction was carried out for 6 minutes, and subsequently, measured at 734 nm with a reader SpectraMax iD3 (Molecular Devices, USA). The results were expressed as vitamin C equivalent in mg per 100 cm^3 (VCEAC mg / 100 cm^3). The analysis was carried out in five replicates.

Total polyphenol content (TPC)

The samples were diluted in demineralized water. A 20 µl portion of the prepared sample dilution was poured into a 96-well plate (NEST Biotechnology; Wuxi, China), and 100 µl of Folin-Ciocalteu (F-C) reagent (Chempur, Piekary Śląskie, Poland) was added. The plate was left for 5 minutes at room temperature in the dark. Subsequently, 80 µl of a solution of 7.5 g/100 cm^3 of sodium carbonate (Chempur, Piekary Śląskie, Poland) was poured into the wells. The samples were mixed for 5 minutes at 150 rpm and left for 2 hours in the dark. The analysis was performed at a wavelength of λ = 750 nm using the SpectraMax iD3 reader (Molecular Devices, San Jose, CA, USA). The samples were mixed for 1 minute in SpectraMax iD3 before measurement. The experiments were carried out in five independent replicates. The results were expressed as gallic acid equivalent in mg per 100 cm^3 (GAE mg / 100 cm^3).

Sensory analysis

The prepared beverage samples were analyzed using the QDP method (Quantitative Descriptive Profiles) according to the ISO 13299:2016 standard. The tested samples were placed in transparent, disposable lided containers with a capacity of 25 mL. All the samples were randomly coded and given to the raters in random order. The intensity of the determinants was assessed using a structured linear scale (0 ÷ 10). Before the sensory analysis, the evaluating team was trained using the QDP method. Each of the experts for sensory evaluation had at least 5 years of experience in examination using this method. The sensory characteristics of the odor were citrus, cider, tea sweet, fermentation, autolytic and yeast. The sensory characteristics of the flavor were citrus, cider, tea sweet, sour, bitter, autolytic and additionally overall quality. Between the evaluated trials, the experts got still water to neutralize the flavors. The analyses were performed in six independent replicates.

Statistical analysis

The statistical analysis of the results was carried out using Statistica 13.3 (StatSoft, Kraków, Poland) and Microsoft Excel 2019 (Microsoft; Redmond, WA, USA). Means and standard deviations were calculated. The homogeneity of the variance and the normality of the distribution of the results were checked. If the data was parametric, an analysis of variance (ANOVA) with Tukey's post hoc test was performed. If the data was non-parametric, the Kruskal-Wallis rank ANOVA test was used.

Results and discussion

Starter cultures may contain only live, defined and specially selected microorganisms with the American GRAS (Generally Recognized as Safe) status and also entry by the European Food Safety Authority on the QPS (Qualified Presumption of Safety) list. Starter cultures consist of selected strains of bacteria, mold or yeast. Their use in food production is always purposeful to obtain specific sensory, microbiological and physicochemical properties in the finished product.

Yeast is responsible for the sensory characteristics of alcoholic beverages such as wines, beers, ciders or others. The focus was on the influence of the yeast strains that differed in their metabolic properties and changed the sensory characteristics and composition of alcoholic beverages like antioxidant capacity, alcohol content, extract reduction and polyphenol variation. Various strains of *Saccharomyces cerevisiae* were used to prepare the drinks. The yeast utilized had different fermentation properties, such as tolerance to low pH value, alcohol production level, carbohydrates fermentation properties and specificity of aromatic compound production. Further, the probiotic

yeast strain *Saccharomyces boulardii* was used to compare its usefulness with commercial yeast strains.

The lowest number of yeast was found in the case of the variant *S. cerevisiae var. boulardii*, averaging 2.9 log CFU/cm^3 beverage. This result does not allow to define this beverage as a product with probiotic features, where the minimum concentration of live probiotic cells is at an average level of 6 log CFU/cm^3 [10].

The analysis of pH values verified the correct fermentation process in the tested beverages. The results of the pH value (Table 2) of the fermented beverages obtained differed significantly ($p < 0.05$). The control variant, i.e. Kombucha (K), was characterized by the highest pH value. A similar pH value to Kombucha was obtained by the sample referenced with brewing yeast M29 (pH = 3.5). The beverages with wine yeast CKS102 and probiotic *S.b.* had a pH value of 3.4. The lowest pH value (pH = 3.3) had samples with brewing yeast (M12, M21, and M44). The yeast strains significantly changed the pH value of the designed beverages ($p < 0.05$). The addition of yeast to a Kombucha-type drink slowed down the process of acidification of drinks. This most likely affected the fermentation activity of the native microflora of this drink, which is mainly responsible for the synthesis of organic acids [22]. Although yeast produces organic acids causing the acidification of the environment, it does not synthesize them in large quantities [14]. The organic acids in fermented beverages are associated with health-promoting properties [31].

It should be noted that the alcohol content is approximate for all samples due to the high measurement error of the method used. Nevertheless, the obtained values indicate the percentage of sugar attenuation from the medium and the fermentation capacity of individual yeast strains. The alcohol content in the designed beverages was 2.5 % (samples M12, M29) and 3.0 % (samples M21, M44, CK S102, *S.b.*) presented in Table 2. The M12 and M29 strains were characterized by lower ethanol synthesis. According to Stachowiak et al. [28], low-alcohol beers are those that contain approximately 1 ÷ 3.5 % (v/v) of alcohol. The content of ethanol in the analyzed samples is related to the strain dependency of the yeast. This coincides with the results of the microbiological analysis (Table 2). There was a significant difference ($p < 0.05$) in the number of yeast in the final products. The highest number of yeast was recorded in sample M44 with brewer's yeast (5.18 log CFU/cm^3), and the lowest in the sample with probiotic yeast *S.b.* (2.89 log CFU/cm^3). This result also demonstrates the excellent adaptation of the M44 brewing strain to the proposed Kombucha-based beverages in terms of survivability, low pH tolerance and fermentation properties. *S. cerevisiae* is a model microorganism used in the fermentation of beverages such as wine, beer and cider. It shows the ability to process glycolysis and ethanol fermentation [26]. In the study, the probiotic strain *S.b.* did not show technological usefulness at the same level as wine and brewing yeast. Specific fermentation conditions such as temperature, time

and type of raw material used are important factors affecting the number of probiotic microorganisms in the production of fermented beverages. Scientists showed that *S. boulardii* optimally grows at 37 °C and pH 4.5 ÷ 6.5 [6, 8]. Other researchers applied *S. boulardii* to beer beverages, however, the products had low quality. The strain used caused the deterioration of the quality of the prepared beverages, the destabilization of the fermentation process and the excessive production of aldehydes, esters and aliphatic and aromatic alcohols, which changed the quality of the beverages [7].

Table 2. Summary of results: alcohol content, pH value, number of yeast (n = 3) in the final product
Tabela 2. Podsumowanie wyników: zawartość alkoholu, wartość pH, liczba drożdży (n = 3) w produkcie

Sample / Próbka	Initial Blg / Początkowe Blg	Final Blg / Końcowe Blg	Approximate content EtOH / Przybliżona zawartość EtOH	pH	The number of yeast [log CFU/cm^3] / Liczba drożdży [log jtk/cm^3]
K	6	-	-	3.6^{a}±0.0	-
M12	6	1	2.5 %	3.3^{b}±0.0	4.3^{ab}
M21	6	0.1	3.0 %	3.3^{b}±0.1	4.2^{ab}
M29	6	1	2.5 %	3.5^{a}±0.1	4.6^{b}
M44	6	0.1	3.0 %	3.3^{b}±0.0	5.2^{c}
CK S102	6	0.1	3.0 %	3.4^{c}±0.0	4.4^{ab}
S.b.	6	0.1	3.0 %	3.4^{c}±0.0	2.9^{a}

Explanatory notes / Objaśnienia:
CFU- Colony Forming Unit / jtk- jednostki tworzące kolonie / Letters a, b, c mean the statistical difference between samples in Tukey's post-hoc test ($p < 0.05$) ANOVA / Litery a, b, c oznaczają statystyczną różnicę między próbami w teście post-hoc Tukeya ($p < 0,05$)

The presence of AABs, the natural microflora of Kombucha, was not detected in the tested samples. The AABs may have been inactivated during the maturation process. Similar observations were found in the study of Da Silva et al. [4], which concerned an innovative fermented beer based on Kombucha.

The samples were tested for antioxidant activity and the total polyphenol content (Figure 3). Statistical significance ($p < 0.05$) was demonstrated between the samples from both analyses. The highest content of antioxidant compounds and total polyphenols was detected in the beverage with wine yeast CK S102 (41.87 mg VCEA/100 cm^3; 100.82 GAE/100 cm^3). The probiotic yeast used (*S.b.*) had a significant effect on the antioxidant activity and polyphenol content. Capece et al. [2] used *S. boulardii* for fermentation craft beers. The study showed that probiotic strains determined an increase in antioxidant properties and polyphenol content in beer. Similar results were obtained by Mulero-Cerezo et al. [18], where the antioxidant activity was

significantly higher in beer fermented with probiotic yeast. The M21 sample had the lowest antioxidant activity (38.41 mg VCEA/100 cm^3) and the lowest content of polyphenols (93.44 mg GAE/100 cm^3). The results are related to the strain feature regarding the metabolic properties of the M21 yeast strain. This strain has low fermentability and is commercially used to produce light wheat beers. Moreover, some authors note that the alcohol level can influence the antioxidant capacity of the material studied. In this study, this dependence did not exist, and only metabolic differences between yeast strains influenced the results [9, 20].

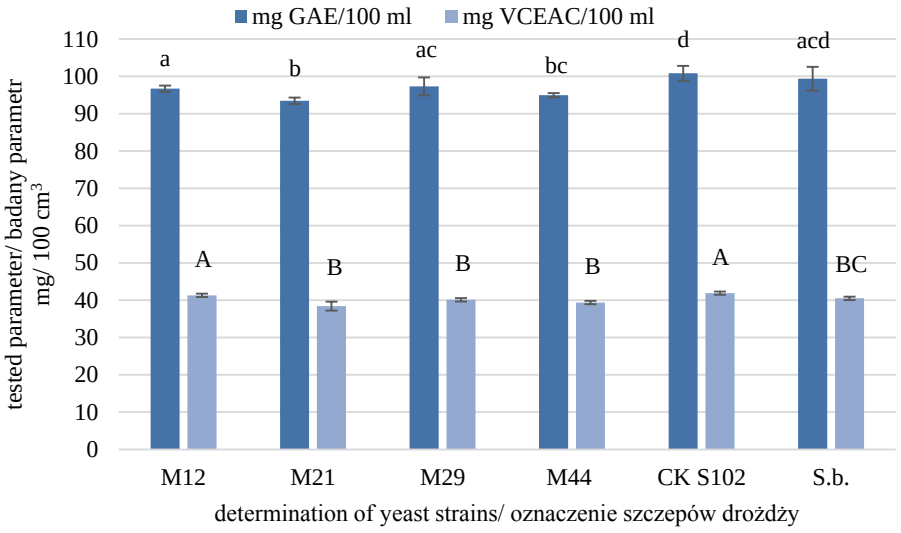

Fig. 3. Antioxidant activity [mg VCEAC/ 100 cm^3] and total polyphenol content [mg GAE/ 100 cm^3], n = 6

Rys. 3. Aktywność antyoksydacyjna [mg VCEAC/ 100 cm^3] i zawartość polifenoli ogółem [mg GAE/ 100 cm^3], n = 6

Explanatory notes / Objaśnienia:
VCEAC [mg/ 100 cm^3] - vitamin C equivalent, GAE [mg/ 100 cm^3] - gallic acid equivalent / VCEAC [mg/ 100 ml] - ekwiwalent witaminy C, GAE [mg/ 100 cm^3] - ekwiwalent kwasu galusowego / Letters A, B, C mean the statistical difference between the samples in the analysis of antioxidant activity ($p < 0.05$) / Litery A, B, C oznaczają statystyczną różnicę między próbami w analizie aktywności antyoksydacyjnej ($p < 0,05$) / Letters a, b, c, d mean the statistical difference between the samples in the analysis of polyphenol content ($p < 0.05$) / Litery a, b, c, d oznaczają statystyczną różnicę między próbkami w analizie zawartości polifenoli ($p < 0,05$) / Kruskal-Wallis statistical ANOVA test of ranks was used /Zastosowano test statystyczny- ANOVA rang Kruskala-Wallisa / Error bars represent standard deviation/ Słupki błędów oznaczają odchylenie standardowe

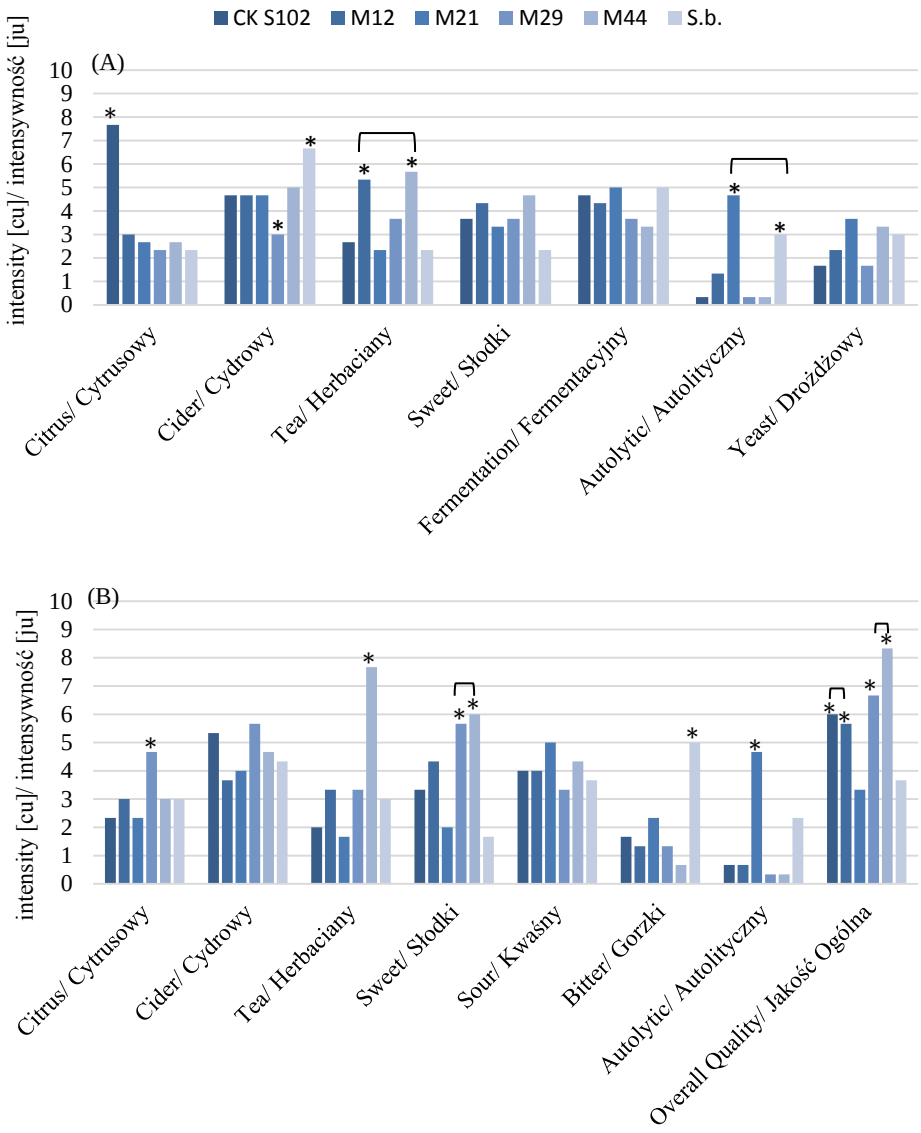

Fig. 4A, B. Results of sensory analysis – smell (A), taste and general quality (B) of the tested samples
Rys. 4A, B. Wyniki analizy sensorycznej – zapachu (A), smaku i jakości ogólnej (B) badanych próbek
Explanatory notes / Objaśnienia:
cu- conventional units / ju- jednostki umowne / *- mean the statistical difference between samples in Tukey's post-hoc test ($p < 0.05$) ANOVA / *- oznaczają statystyczną różnicę między próbami w teście post-hoc Tukeya ($p < 0,05$) ANOVA/ brackets indicate no differences between selected samples / klamry wskazują na brak różnic pomiędzy zaznaczonymi próbkami

In addition, *S. cerevisiae* synthesizes phenolic compounds with high antioxidant potential [26]. A study by Datt et al. [5] showed that probiotic strains of *S. boulardii*, compared to other *S. cerevisiae*, are richer in polyphenolic metabolites. This reflects the antioxidant capacity of these microorganisms. In terms of health-promoting properties, the study by Datta et al. [5] highlights the potential of using probiotic yeast in the industrial production of fermented beverages.

A sensory analysis of the odor (Figure 4A), flavor and overall quality (Figure 4B) of the designed fermented beverages showed a statistical difference ($p < 0.05$) between the tested samples. The intensity of the citrus odor was most noticeable for the CK S102 sample (7.67 cu). The wine yeast tested has a dry sensory profile and is used in white wines and dry ciders [12]. The highest tea odor intensity was determined for M12 (5.33 cu) and M44 (5.67 cu), thus indicating no differences between the selected samples. The M21 (4.67 cu) and *S.b.* samples showed no significant difference in the autolytic odor. (3.00 cu). However, the sensory profile of the samples fermented with probiotic yeast (*S.b*), low overall quality was obtained. An intensely autolytic odor and taste and a bitter taste were observed.

The highest overall quality was obtained by the M44 sample (8.33 cu). Additionally, M44 had the most intense tea flavor (7.67 cu). This sample had the highest intensity of the sweet flavor. Bingman et al. [1] indicate that brewer's yeast, with characteristics in common with the M44 strain, including a delicate profile of volatile compounds and medium fermentation of must sugars, is a good choice for the production of cider with a slightly sweet and floral aroma. At the same time, the orientation of the flavor and aroma profile of the beverages through fermentation with yeast made the M44 sample similar to well-known and gaining popularity ciders [1]. This effect most probably contributed to the high overall quality assessment of the designed M44 beverage. The selection of the appropriate yeast strain affects the characteristics of the fermented beverage obtained, which is related to the metabolic pathways of aromatic and flavor compounds [22].

Conclusion

1. It was demonstrated that the best starter culture for low-alcohol fermented beverages based on Kombucha is wine strain yeast CK S102. It was possible to obtain a product with good antioxidant capacity, a high content of polyphenols and high sensory quality with a noticeable hint of citrus aroma and cider flavor.
2. It was found that the M44 strain produced a Kombucha-based fermented beverage with an alcohol content of 3 % and the best sensory quality and antioxidant potential out of all the four brewing yeast starter cultures used.
3. Probiotic yeast *S. cerevisiae var. boulardii* for Kombucha-based alcoholic beverages did not show technological usefulness. The product had comparable antioxi-

dant potential to CK S102, the worst sensory quality and a low number of yeast cells, without ensuring the probiotic effect of such a product.

4. The designed fermented beverages with a low alcohol content, high antioxidant potential and good sensory quality may be a better alternative to commercial alcohol products. It is necessary to conduct further research to select the appropriate yeast strain and obtain the desired chemical composition of the beverage.

Acknowledgments

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PRZYDATNOŚĆ FERMENTOWANEJ HERBATY KOMBUCHA DO PRODUKCJI NAPOJÓW NISKOALKOHOLOWYCH

S t r e s z c z e n i e

Wprowadzenie. Wzrastające zainteresowanie konsumentów żywnością fermentowaną oraz chęć poprawy swojego zdrowia i samopoczucia, przyczynia się do rozwoju rynku napojów funkcjonalnych, które są bogate w związki biologicznie czynne, wpływające pozytywnie na organizm człowieka. Jednym z takich napojów jest azjatycka fermentowana herbata Kombucha, doceniana ze względu na walory smakowe oraz korzystne właściwości prozdrowotne. Celem pracy był dobór odpowiedniej kultury startowej drożdży do produkcji fermentowanych napojów niskoalkoholowych na bazie Kombuchy o dobrej jakości mikrobiologicznej, sensorycznej oraz wysokiej aktywności antyoksydacyjnej. Zakres badań obejmował opracowanie procesu technologicznego napoju herbacianego Kombucha z dodatkiem drożdży winiarskich, piwowarskich i probiotycznych, a następnie określenie jakości zaprojektowanych fermentowanych napojów niskoalkoholowych. Metodyka badawcza obejmowała analizę kwasowości czynnej i zawartości alkoholu, analizę mikrobiologiczną, aktywność antyoksydacyjną i zawartość polifenoli ogółem oraz analizę sensoryczną.

Wyniki i wnioski. Na podstawie przeprowadzonych badań stwierdzono, że otrzymywanie niskoalkoholowych napojów fermentowanych na bazie Kombuchy jest możliwe, a jakość tych produktów uzależniona była od kultur startowych drożdży, które wpłynęły istotnie na wartości pH, zawartość alkoholu, potencjał antyoksydacyjny i zawartość polifenoli ogółem oraz profil sensoryczny produktu finalnego. Otrzymane napoje niskoalkoholowe cechowały się wysoką zawartością związków antyoksydacyjnych oraz pożądaną jakością mikrobiologiczną i sensoryczną. Uzyskane wyniki stanowią pilotaż do dalszych badań nad przydatnością fermentowanej herbaty Kombucha do produkcji napojów niskoalkoholowych.

Słowa kluczowe: Kombucha, kultury startowe drożdży, niskoalkoholowe napoje fermentowane, aktywność antyoksydacyjna, polifenole