DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

Physicochemical And Organoleptic Quality Testing Of Millet Microgreen Juice (Panicum Miliaceum L.) On Different Milet Types And Plant Age

Indah Kurnia Praise Sustainable[1], Fadjar Kurnia Hartati[2*], Adhania Andika Prayudanti[3], Nunuk Hariyani[4]

Food Technology Department, Faculty of Agriculture, Dr. Soetomo University, Surabaya, Indonesia

Email: indhkrnia@gmail.com[1], fadjar.kurnia@unitomo.ac.id[2*], andhania@unitomo.ac.id[3], nunukhariyani195@yahoo.com[4]

Orcid: https://orcid.org/0000-0002-9039-2161[2*]

Abstract. This research has taken place using experimental laboratory methods of quantitative analysis. The variables used include varieties consisting of yellow millet and red millet, and plant life ranging from 6 days, 9 days, 12 days, and 15 days. The data obtained was analyzed based on parametric statistics using ANSIRA, using statistical product and service solution (SPSS) with version 24 and determining best treatment using effectiveness tests and determining antioxidant levels of best treatment. Different types and ages of plants have very real effects on reduced sugars, phenols, vitamin C, flavonoids and total soluble solids. Significant treatment between different plant types and ages resulted in a 6-day-old ryellow millet (MG1) being the best treatment with a result value (NH) of 0.73 with the parameter criterion reduction sugar level of 1.48%, total phenol content of 27.26 mg GAE/100mg, vitamin C 2.05 mg/100 mg, total flavonoid content of 4.98 mg QE/100 Mg, TPT 11.36 mg/L, color 4.81 (neutral), flavor 5.16 (few likes) and aroma 5.4 (few likes).

Keywords: Chemical Quality, Millet, Microgreens

1 Introduction

Increased awareness of the importance of a healthy lifestyle has driven strong interest in research into the potential of certain plants in supporting human health. One plant that is attracting attention is microgreens, which are known to be rich in protein, antioxidants, vitamins, minerals and enzymes that can provide significant health benefits.[1]. Microgreens have also been in the spotlight because they are often grown organically, without the use of chemicals such as synthetic fertilizers, and have a relatively short harvest period, around 7-14 days, making them an attractive option for a quick, quality source of nutrients. Microgreens come in a variety of varieties, including millet microgreens, which are the focus of this research. Millet, as a type of cereal crop, has the potential to overcome hunger problems because of its high fiber content[2].However, the use of millet as a raw material for functional drinks is still less explored. Differences in nutritional content between different types of millet, such as yellow and red millet, can affect the quality and health benefits of microgreen juice[3]. The importance of determining the correct age of seeds in millet processing is also recognized, so that plants can grow optimally and produce quality vegetative parts.[4]. From this description, it is concluded that further research is needed in the form of chemical and organoleptic tests on millet microgreens juice drinks. This research aims to understand the physicochemical and organoleptic qualities of microgreen juice, especially for various types of millet and different plant ages. Preliminary research results show panelists' preference for microgreen juice drinks at certain plant ages, which is the basis for this further investigation.

2 Method

2.1 Types of Research

The type of research used in this research is a quantitative research method with a laboratory experimental type. Research is an effort to identify the impact of variables that have been manipulated or tightly controlled on other variables, with the aim of understanding the relationship and influence of these variables on the goals and problems studied in the laboratory.[11].

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

2.2 Place and Time of Research

Chemical research was carried out in the Food Technology Chemistry and Microbiology Laboratory, organoleptic research was carried out in the Food Technology kitchen and physical research was carried out in the Aquatic Resources Utilization Laboratory, Faculty of Agriculture, University of Dr. Soetomo Surabaya. This research was carried out from June – August 2023.

2.3 Research Support Materials and Tools

The research used millet as the main ingredient which was obtained from Lamongan district through distributors in Rungkut District, Surabaya City. In addition, for chemical analysis, the materials and tools used include:

1. Reducing Sugar Test: Luff Schoorl solution, 20% H2SO4 solution, 1% starch indicator, 20% KI solution, 4N HCl solution, 50% NaOH solution, PP indicator, and distilled water. Tools used include Erlenmeyer flasks, burettes, filter paper, and pipettes.
2. Total Phenol Content Test: Folin Ciocalteau Solution and 20% Na2CO3. The equipment used includes spectrophotometry, freezers, freeze dryers, magnetic stirrer centrifuges, analytical scales and glassware.
3. Vitamin C Test: Test tube, dropper pipette, test tube clamp, tripod, Bunsen, thermometer, measuring cup, mineral water glass, test tube rack, H2SO4, starch, gauze and distilled water.
4. Flavonoid Content Test: AlCl3, potassium acetate 120 mM. The equipment used includes a blender, digital balance, vortex, 60 mesh sieve, stirrer, centrifuge, oven, drying rack, micropipette, UV-Vis spectrophotometer and glassware.
5. Total Dissolved Solids (TPT): A refractometer tool with materials that are ground by pounding.
6. Antioxidant Test: Running water, 1,1-diphenyl-2-picrylhydrazyl (DPPH), ethanol 96%, methanol pro analysis. The equipment used includes a beaker, spatula, filter paper, digital balance, vial, visible spectrophotometer, and measuring flask.

2.4 Research Procedure

The research was carried out in several stages, starting from preliminary research to find out the results that can be obtained from the use of microgreens. Ingredient selection was done by choosing yellow and red millet seeds. The process of planting microgreens uses rockwool planting media with watering treatment every afternoon. Plant maintenance is carried out by watering from planting to harvest. Harvesting is done when the microgreens meet the requirements by cutting above the planting medium line[12]. The sample preparation process to making millet microgreens juice refers to modified previous research references[13].

2.5 Data Analysis Technique

The data that has been collected is analyzed using parametric statistical methods, namely Variety Analysis (ANSIRA), using Statistical Product and Service Solution (SPSS) software version 24. If the results of the analysis show that there is a significant difference between treatments ($p<0.05$) , an additional test will be carried out using the Least Significant Difference Test (BNT) / Honest Significant Difference (BNJ) / Duncan with a confidence level of $\alpha = 5\%$ depending on the value of the Diversity Coefficient (KK). If the KK value is below 5% then use the BNT test, if the KK value is 5-10% then use the BNJ test and if the KK value is above 10% use the Duncan test (Kusriningrum, 2008). Non-parametric data such as organoleptic tests of color, taste, aroma and tenderness are evaluated based on the average preference value given by the panelists. To assess whether a treatment has a significant impact on these organoleptic tests, the Kruskal-Wallis test method is used.[14]. Screening of the best treatments from all research is carried out using effectiveness tests[15].

3 Results and Discussion

3.1 Reduced Sugar Levels

The results of research on reducing sugar in millet microgreens juice for different types of millet and plant ages can be seen in Table 1 below:

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

Table 1. Average Reducing Sugar Content of Millet Microgreens Juice

Treatment Code	Treatment	Average reducing sugar content (%)
MG3	*Microgreens*12 day old yellow millet	0.58a
MG2	*Microgreens*9 day old yellow millet	0.70a
MG6	*Microgreens*9 day old red millet	0.94ab
MG7	*Microgreens*12 day old red millet	1.02abc
MG4	*Microgreens*15 day old yellow millet	1.24bc
MG8	*Microgreens*15 day old red millet	1.30bc
MG1	*Microgreens*6 day old yellow millet	1.48c
MG5	*Microgreens*6 day old red millet	1.54c
KK = 1.68 (BNT)		

Note: The same letter behind the same number in the mean indicates there is no significant difference in the BNT test with a confidence level of less than 5%.

The results of ANSIRA analysis show that variations in plant type and age have a significant influence on the reducing sugar content in millet microgreens juice. It can be seen that the MG5 treatment has the highest reducing sugar content, namely 1.54%, while the lowest reducing sugar content results are found in the MG3 treatment with an average of 0.58%. The results of the research show that the tendency for higher age to result in lower levels of reducing sugar. The longer the age given, the more influence it will have on the process of increasing sugar reduction. Reducing sugars are formed as a result of an inversion process, one of which is influenced by the type and age of the plant. Table 3 shows that red millet plants aged 6 days produce higher levels of reducing sugar than yellow millet aged 12 days.

In yellow millet, it can be seen that treatment MG1 has a value of 1.48%, treatment MG2 has a value of 0.70%, treatment MG3 has a value of 0.58%, treatment MG4 has a value of 1.24%. This result is different from that produced by red millet, as seen in the MG5 treatment which has a value of 1.54%, the MG6 treatment has a value of 0.94%, the MG7 treatment has a value of 1.02%, the MG8 treatment has a value of 1.30%. These results show that the treatment of yellow millet and red millet had the same high yield, namely in the MG1 treatment the plants were 6 days old and in the MG5 treatment the plants were 6 days old.

3.2 Total Phenol Content

The results of research on total phenol levels in millet microgreens juice for different types of millet and plant ages can be seen in Table 2 below:

Table 2. Mean total phenol content of millet microgreens

Treatment Code	Treatment	Average total phenol content (%)
MG5	*Microgreens*6 day old red millet	14.79a
MG3	*Microgreens*12 day old yellow millet	17.75b
MG4	*Microgreens*15 day old yellow millet	18.39b
MG7	*Microgreens*12 day old red millet	18.41b
MG6	*Microgreens*9 day old red millet	19.78c
MG2	*Microgreens*9 day old yellow millet	20.02c
MG8	*Microgreens*15 day old red millet	21.29d
MG1	*Microgreens*6 day old yellow millet	27.26e
KK = 1.40% (BNT)		

Note: If the same letter appears behind the same number in the mean, this indicates that there is no significant difference in the BNT test < 5%.

Based on the results of ANSIRA analysis, it shows that variations in plant type and age have a very significant impact on total phenol levels. It can be seen that the highest mean phenol was in the MG1 treatment with a value of 27.26%, while the lowest total phenol content was in the MG5 treatment with a value of 14.79%. This is thought to be due to treatment at planting age which causes total phenol levels to decrease. The highest microgreens juice samples had high total phenols. The purpose of this test is to verify that the total amount of compounds contained in the phenolic compound content in the sample is high, so that the antioxidant activity is also high. Polyphenolic compounds found in plants include phenolic acids, flavonoids and tannins.

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

In yellow millet, it can be seen that treatment MG1 has a value of 27.26%, treatment MG2 has a value of 20.02%, treatment MG3 has a value of 17.75%, treatment MG4 has a value of 18.39%. This result is different from that produced by red millet, as seen in the MG5 treatment which has a value of 14.79%, the MG6 treatment has a value of 19.78%, the MG7 treatment has a value of 18.41%, the MG8 treatment has a value of 21.29%. Yellow millet has the highest phenol value compared to red millet, proving that red millet and yellow millet have a high total phenol depending on the type of millet used, such as yellow millet having the highest total phenol in the MG1 treatment, namely 6 days old and the highest red phenol content. found in the 15 day MG8 treatment.

3.3 Vitamin C Test

The results of research on vitamin C millet microgreen juice on different types of millet and plant ages can be seen in Table 3 below:

Table 3. Average Vitamin C for Millet Microgreens Juice

Treatment Code	Treatment	Mean vitamin C levels (%)
MG4	*Microgreens*15 day old yellow millet	1.82a
MG5	*Microgreens*6 day old red millet	1.83a
MG3	*Microgreens*12 day old yellow millet	1.85a
MG7	*Microgreens*12 day old red millet	1.88a
MG2	*Microgreens*9 day old yellow millet	1.97b
MG6	*Microgreens*9 day old red millet	1.99bc
MG1	*Microgreens*6 day old yellow millet	2.05c
MG8	*Microgreens*15 day old red millet	2.25d
KK = 1.18% (BNT)		

Note: If the same letter appears behind the same number in the mean, it indicates there is no significant difference in the BNT test with a confidence level of less than 5%.

Based on the results of ANSIRA analysis, it shows that variations in plant type and age in millet microgreens juice show a significant influence on vitamin C in millet microgreens juice. It can be seen that the MG8 treatment has the highest vitamin C levels, namely 2.25%, while the lowest results for vitamin C levels are found in the MG4 treatment with an average of 1.85%. This treatment proves that the type of plant makes a real difference, red millet microgreens are proven to have a higher vitamin C content than yellow millet microgreens. The germination process in millet seeds affects the yield of vitamin C in millet, in the germination process the vitamin C content increases depending on the type of millet used.[16]. In yellow millet, it can be seen that treatment MG1 has a value of 2.05%, treatment MG2 has a value of 1.97%, treatment MG3 has a value of 1.85%, treatment MG4 has a value of 1.82%. This result is different from that produced by red millet, as seen in the MG5 treatment which has a value of 1.83%, the MG6 treatment has a value of 1.99%, the MG7 treatment has a value of 1.88%, the MG8 treatment has a value of 2.25%. These results show that the MG1 treatment at 6 days old had the highest vitamin C value compared to the other yellow millet treatments and the MG8 treatment at 15 days old had a higher value than the other red millet treatments. This shows that the vitamin C levels in yellow millet tend to decrease as time passes in the planting process, while in red millet, the longer it is planted, the vitamin C levels actually increase.

3.4 Total Flavonoid Levels

The results of research on the flavonoid levels of millet microgreens juice in different types of millet and plant ages can be seen in Table 4 below:

Table 4. Mean flavonoid content of millet microgreens juice

Treatment Code	Treatment	Mean flavonoid content (%)
MG5	*Microgreens*6 day old red millet	3.02a
MG3	*Microgreens*12 day old yellow millet	3.56b
MG7	*Microgreens*12 day old red millet	3.62b
MG2	*Microgreens*9 day old yellow millet	3.77c
MG4	*Microgreens*15 day old yellow millet	3.96d
MG6	*Microgreens*9 day old red millet	4.01de

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

MG8	*Microgreens*15 day old red millet	4.07e
MG1	*Microgreens*6 day old yellow millet	4.98f
KK = 9.27% (BNJ)		

Note: If the same letter is followed by a number in the mean, this indicates that there is no significant difference in the Honestly Significant Difference (BNJ) test with the specified level of confidence. more than 5%

The results of ANSIRA analysis show that variations in plant type and age have a very significant impact on the total flavonoid content in millet microgreens juice. It can be seen that the highest mean flavonoids were found in the MG1 treatment with a value of 4.98%, while the lowest total flavonoid levels were found in the MG5 treatment with a value of 3.02%. Flavonoids are bioactive compounds that have great benefits in preventing the buildup of cholesterol on the walls of blood vessels and contain antioxidants that can ward off free radicals that trigger cancer.[17]. Flavonoids are the most abundant group of polyphenolic compounds. Flavonoids have the ability to reduce the risk of cardiovascular disease by inhibiting fat oxidation. Research conducted by Lina[18]Flavonoids have a tendency to be unstable to oxidation, exposure to light, and chemical changes. If it undergoes oxidation, its structure will change and its effectiveness as an active ingredient will decrease.

Table 6 shows that the MG1 yellow millet treatment had a higher total flavonoid value than the MG5 red millet treatment. In Table 6 it can be seen that yellow millet in treatment MG1 has a value of 4.98%, treatment MG2 has a value of 3.77%, treatment MG3 has a value of 3.56%, treatment MG4 has a value of 3.96%. This result is different from that produced by red millet, as seen in the MG5 treatment which has a value of 3.02%, the MG6 treatment has a value of 4.01%, the MG7 treatment has a value of 3.62%, the MG8 treatment has a value of 4.07%. The flavonoid content test proved that the red millet type had a lower flavonoid value compared to the yellow millet type.

3.5 Total Dissolved Solids (TPT) Content

The results of research on total dissolved solids on different types of millet and plant ages in millet microgreens juice can be seen in Table 5 below:

Table 5. Mean total soluble solids content of millet microgreens juice

Treatment Code	Treatment	Mean TPT levels (%)
MG3	*Microgreens*12 day old yellow millet	8.33a
MG7	*Microgreens* red millet aged 12 days	8.40a
MG8	*Microgreens*15 day old red millet	9.47ab
MG2	*Microgreens*9 day old yellow millet	9.66ab
MG4	*Microgreens*15 day old yellow millet	9.76ab
MG6	*Microgreens*9 day old red millet	10.30bc
MG1	*Microgreens*6 day old yellow millet	11.36c
MG5	*Microgreens*6 day old red millet	11.66c
KK = 5.57% (BNJ)		

Note: The letter after the number with the same notation as the mean indicates there is no difference in the BNJ test > 5%.

Based on ANSIRA results, it shows that different types and ages of plants have a very significant influence on TPT levels in millet microgreens juice. It can be seen that the highest TPT average was in the MG5 treatment with a value of 11.66%, while the lowest TPT level was in the MG3 treatment with a value of 8.33%. Table 7 shows that 6 days old has a higher TPT than 15 days old. It is suspected that in treatments MG1 and MG5, the younger the product, the higher the total solids produced. In Table 8 it can be seen that yellow millet in treatment MG1 has a value of 11.36%, treatment MG2 has a value of 9.66%, treatment MG3 has a value of 8.33%, treatment MG4 has a value of 9.76%. This result is different from that produced by red millet, seen in the MG5 treatment which has a value of 11.66%, the MG6 treatment has a value of 10.30%, the MG7 treatment has a value of 8.40%, the MG8 treatment has a value of 9.47%.

Total dissolved solids have a close relationship with the reducing sugar content produced in a treatment, if the sugar content in a sample has a high value, the TPT produced will also be higher. It can be seen that in treatments MG5 and MG1, plants harvested at the age of 6 days have the same total soluble solids value compared to plants with a longer harvest age. This is also proven by the reduction sugar content test carried out on microgreens that has the highest results in the treatment. MG1 and MG5 have the same harvest age, namely 6 days.

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

3.6 Organoleptic

The aim of the organoleptic test is to measure the panelists' level of preference for the treatment given, where the panelists are asked to provide their personal responses regarding preferences subjectively. The results of the hedonic scale analysis are represented in the form of a numerical scale that takes into account the level of preference. The scale applied is as follows: 1= strongly dislike, 2= dislike, 3= somewhat dislike, 4= neutral, 5= somewhat like, 6= like, 7= like very much.

3.7 Color

The color preference test results for millet microgreens juice showed that the MG3 treatment had the highest color preference value, namely 5.42, indicating that the panelists considered the color of millet microgreens juice to be quite favorable. The average color of millet microgreens juice can be seen in Figure 1:

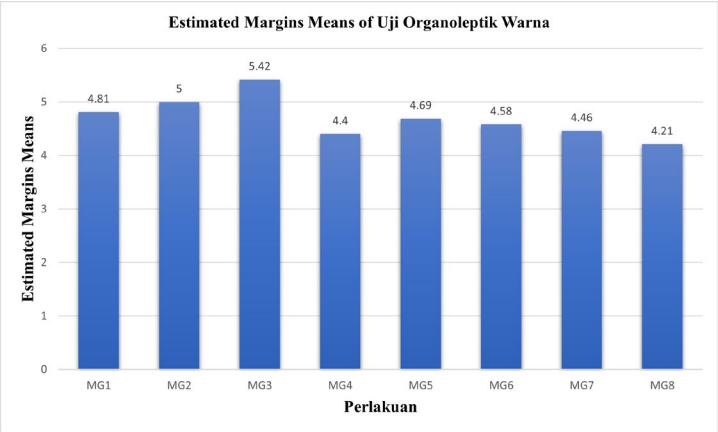

Figure 1. Color Organoleptic Histogram

Figure 1 above shows that the 6 day old MG1 yellow millet treatment gave a millet microgreens juice color value of 4.81, which means the panelists rated the millet microgreens juice color as somewhat liking it, the 9 day old MG2 yellow millet treatment gave a value of 5 which the panelists rated somewhat liking. MG3 yellow millet aged 12 days gave a value of 5.42 which was rated like by the panelists, treatment of red millet MG4 aged 15 days gave a value of 4.4 which was considered neutral by the panelists, treatment of red millet MG5 aged 6 days gave a value of 4.69 which was rated somewhat liked by the panelists, millet treatment red MG6 aged 9 days gave a score of 4.58 which was rated as somewhat favorable by the panelists, the red millet treatment MG7 aged 12 days gave a score of 4.46 which was considered neutral by the panelists, the treatment of red millet MG8 aged 15 days gave a score of 4.21 which was rated neutral by the panelists.

If we look at the quality criteria for herbal drinks set by SNI 3836: 2013 for color which is typical of herbal products, then millet microgreens juice with an average value of 4.21 to 5.42 which is rated as somewhat favorable is stated to be in accordance with applicable regulations because it is typical. Microgreen juice has a green color and is not mixed with other colors. The panelists did not like the MG4 and MG8 treatments because the color produced at 15 days was too thick so that the resulting juice had a dark green color which made the juice unattractive to consume. The histogram above indicates that the MG3 behavior has the highest color value, namely 5.42, indicating that millet microgreens juice is considered somewhat preferred by the panelists because the color in the MG3 treatment is slightly lighter green than the other treatments.

3.8 Flavor

The results of the taste preference test for millet microgreens juice showed that MG4 gave the highest liking score for the taste, namely 9.66, indicating that the taste of millet microgreens juice was liked by the panelists. The average millet microgreens juice can be seen in Figure 2.

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

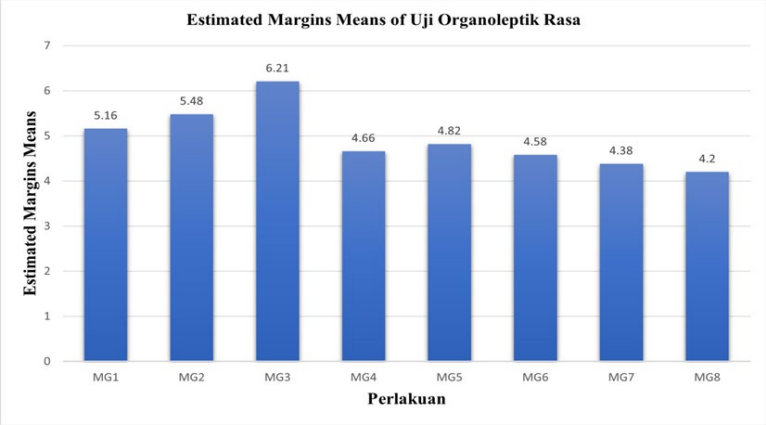

Figure 2. Organoleptic Histogram of Taste

Figure 2 above shows that the 6 day old MG1 yellow millet treatment gave a taste value of millet microgreens juice, namely 5.16, which means the panelists rated the taste of the millet microgreens juice as somewhat liking it, the 9 day old MG2 yellow millet treatment gave a value of 5.48 which the panelists rated somewhat liking. MG3 yellow millet aged 12 days gave a value of 6.21 which was rated as liked by the panelists, treatment of yellow millet MG4 aged 15 days gave a value of 4.66 which was rated as somewhat liked by the panelists, treatment of red millet MG5 aged 6 days gave a value of 4.82 which was rated as somewhat liked by the panelists, treatment MG6 red millet aged 9 days gave a value of 4.58 which was rated as somewhat favorable by the panelists, treatment of MG7 red millet aged 12 days gave a value of 4.38 which was considered neutral by the panelists, treatment of red millet MG8 aged 15 days gave a value of 4.2 which was assessed as neutral by the panelists.

If we look at the quality criteria for herbal drinks set by SNI 3836: 2013 for taste which is typical of herbal products, millet microgreens juice with an average value of 4.2 to 6.21 is stated to be liked by the reviewer and is declared in accordance with applicable regulations because of the taste. The specialty of this microgreens juice is that it doesn't taste too sweet, bitter, and has a slight grassy taste produced by millet microgreens. It can be seen in the histogram that the MG4 and MG8 treatments were treatments that the panelists did not like because the taste produced by 15 day old millet was quite bitter and the resulting grassy taste became stronger because the longer the plant grew, it produced more and more green pigment. The histogram above shows that MG4's behavior has the highest taste value, namely 6.21, which means that the millet microgreens juice is liked by the panelists. The results of the Kruskal-Wallis analysis on color show that the p value = 0.001 ≤ α = 0.004, indicating that there is a significant difference between each treatment. This indicates that the type and age of the plant influence the level of panelist acceptance of the taste parameters of millet microgreens juice.

3.9 Aroma

The results of the analysis of the preference for the aroma of millet microgreens juice showed that the MG3 treatment received the highest assessment of the aroma with a score of 6.49, indicating that the aroma of millet microgreens juice was liked by the panelists. The average millet microgreens juice can be seen in Figure 3 below:

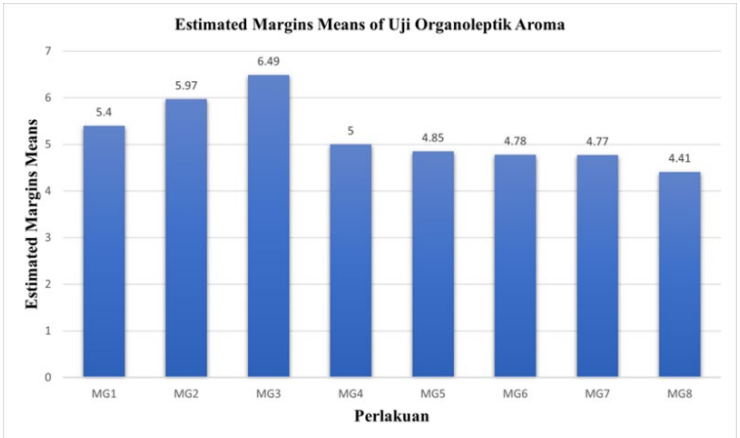

Figure 3. Aroma organoleptic histogram

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

Figure 3 above shows that the 6 day old MG1 yellow millet treatment gave a millet microgreens juice aroma value of 5.4, which means the panelists rated the taste of the millet microgreens juice as somewhat liking it, the 9 day old MG2 yellow millet treatment gave a value of 5.97 which the panelists rated somewhat liking. MG3 yellow millet aged 12 days gave a value of 6.49 which was rated as liked by the panelists, treatment of yellow millet MG4 aged 15 days gave a value of 5 which was rated as somewhat liked by the panelists, treatment of red millet MG5 aged 6 days gave a value of 4.85 which was rated as somewhat liked by the panelists, treatment MG6 red millet aged 9 days gave a value of 4.78 which was rated as somewhat favorable by the panelists, treatment of red millet MG7 aged 12 days gave a value of 4.77 which was considered neutral by the panelists, treatment of red millet MG8 aged 15 days gave a value of 4.41 which was assessed as neutral by the panelists.

If we look at the quality criteria for herbal drinks set by SNI 3836: 2013 for the aroma which is typical of herbal products, millet microgreens juice with an average value of 4.41 to 6.49 is stated to be liked by the researcher and is stated to be in accordance with applicable regulations because of the aroma. The specialty of this microgreens juice is that it has an aroma that is not too strong and has a slight grassy aroma from millet microgreens. The histogrem above shows that MG4 and MG8 have the lowest values compared to the other treatments, this is because the aroma produced by 15 day old millet microgreens has a strong aroma and the grassy aroma increases, causing the panelists to not really like the aroma produced by this treatment. .

The histogram above shows that MG3's behavior has the highest aroma value, namely 6.49, which means that the millet microgreens juice is liked by the panelists. Because the aroma produced is between aromas that are not too strong. The results of the Kruskal-Wallis test on aroma (Appendix 23) show that the p value = 0.001 ≤ α = 0.004, indicating that there is a significant difference between each treatment. This shows that the type and age of the plant influence the level of panelists' acceptance of the aroma of millet microgreen juice.

3.10 Effectiveness Test

Effectiveness tests are carried out to determine the best or most popular treatment. The results of effectiveness tests on all aspects of research parameters, including chemical and organoleptic tests, show that different types and ages of plants are the most optimal treatment because they have the highest value (NH). NH averages for all effectiveness test research parameters can be found in Table 6 below:

Table 6. Effectiveness test

Parameter	Result Value (NH) Treatment							
	MG1	MG2	MG3	MG4	MG5	MG6	MG7	MG8
Sugar	0.13	0.03	0	0.09	0.14	0.05	0.06	0.1
Phenol	0.14	0.06	0.03	0.04	0	0.06	0.04	0.07
Vitamin C	0.07	0.05	0.01	0.02	0	0.05	0.02	0.14
Flavonoids	0.12	0.05	0.03	0.06	0	0.06	0.04	0.07
TPT	0.9	0.39	0	0.42	0	0.59	0.02	0.33
Color	0.06	0.08	0.12	0.02	0.05	0.04	0.02	0
Flavor	0.05	0.07	0.11	0.02	0.03	0.02	0.1	0
Aroma	0.05	0.08	0.11	0.03	0.02	0.02	0.02	0
Total	0.73*	0.45	0.41	0.33	0.24	0.37	0.3	0.42

Explanation * = Best treatment

Based on the determination of the effectiveness test on all parameters, it shows that the 6 day old MG1 yellow millet treatment is the best treatment with a Yield Value (NH) of 0.73% with the parameter criteria being reducing sugar content 1.48%, total phenol content 27.26 mg GAE/100mg, vitamin C 2.05 mg/100mg, total flavonoid content 4.98 mg QE/100mg, TPT 11.36 mg/L, color 4.81 (neutral), taste 5.16 (somewhat like) and aroma 5.4 (somewhat like).

3.11 Antioxidant Test

The results of research on antioxidant activity from the results of instrument readings are obtained through absorbance values which are then used to calculate the percent inhibition value of antioxidants, namely a material that can inhibit free radicals which is related to the concentration of the material being tested.[19]. In this study, the lowest effectiveness test value was in the treatment (MG7) of red millet microgreens aged 12 days, which can be seen in Table 7:

DEMETER: Journal of Farming and Agriculture
Vol 2, Issue 1, March 2024, Page 94-103
ISSN: 2987-5889 (Media Online)
DOI: https://doi.org/10.58905/demeter.v2i1.283

Table 7. Average Juice Antioxidants *microgreens* millet

Treatment Code	Treatment	Average IC50 (µg/mL)
MG7	*Microgreens* red millet, plant age 12 days	8.1%
Source: Internal Data (Processed)		

One of the new concepts introduced recently to interpret the results of the DPPH method is the "effective concentration" or EC50 which is often expressed as the IC50 value. The definition of IC50 is the substrate concentration that causes a 50% decrease in DPPH activity (color). The IC50 value is inversely proportional to antioxidant activity, the higher the antioxidant activity, the lower the IC50 value[20]. Based on the research results obtained, it shows that different types and ages of plants have a significant influence on the antioxidant levels of millet microgreens juice. Where the treatment used is MG7 treatment with an average value of 0.3. Table 8 shows that the IC50 category as an antioxidant:

Table 8. IC50 categories as antioxidants

No.	Category	Concentration (µg/mL)
1	Very strong	< 50
2	Strong	50 – 100
3	Currently	101 – 150
4	Weak	> 150

It can be concluded that the treatment (MG7) aged 12 days with the lowest results showed that the millet microgreens in this treatment still had very strong antioxidant activity according to Table 8.

4 Conclusion

From the results of research on various types and ages of plants, it can be concluded that differences in plant types and ages have a very significant impact on the content of reducing sugars, phenols, vitamin C, flavonoids and TPT. The combination of variations in plant type and age very significantly influences the content of dissolved sugars, phenols, vitamin C, flavonoids and TPT. Based on the determination of the effectiveness test, it shows that the 6 day old MG1 yellow millet treatment is the best treatment with a Yield Value (NH) of 0.73% with the parameter criteria being reducing sugar content 1.48%, total phenol content 27.26 mg GAE/100mg, vitamin C 2.05 mg/100mg , total flavonoid content 4.98 mg QE/100mg, TPT 11.36 mg/L, color 4.81 (neutral), taste 5.16 (somewhat like) and aroma 5.4 (somewhat like).

References

[1] N. Rizkiyah and Wijayanti. PD, "Microgreens as an alternative to cultivating urban agricultural crops," *Proceedings of the National Master of Agribusiness Seminar*, pp. 21–27, Nov. 2022.
[2] I. Dewi, IGA Ekawati, and IDPK Pratiwi, "The Effect of Long Germination of Millet (Panicum milliaceum) on the Characteristics of Flakes,"*Journal of Food Science and Technology*, vol. 7, no. 4, pp. 175–183, 2018.
[3] A. Azis, M. Izzati, and S. Haryanti, "Antioxidant Activity and Nutritional Value of Several Types of Rice and Millet as Indonesian Functional Food Ingredients,"*J Biol (Denpasar)*, vol. 4, no. 1, pp. 45–61, 2015.
[4] AF Febrianti, S. Fajriani, and A. Suryanto, "The Effect of Seed Transplanting Age on Two Hydroponic Systems of Red Lettuce (Lactuca sativa L.) The Effect of Seeds Transplanting on Difference Hydroponic System of Red Lettuce (Lactuca sativa L.), "*Journal of Crop Production*, vol. 7, no. 8, pp. 1443–1450, 20119.
[5] Marlin, "Food Sources of Minor Plants. Maxwell L. Brown.," 2009.
[6] P. Bhuja, "Identification and characterization of the agronomic appearance of local millet in East Nusa Tenggara: Efforts to Revitalize the Diversity of National Food Availability," 2019.
[7] M. Bliss, "Is food the new status symbol. ," 2014.
[8] Milliard. E., Indoor Kitchen Gardening: Turn Your Home Into a year-round Vegetable Garden. *Cool Springs Press*. Chicago.: Chicago Tribune, 2014.
[9] A. Gutierrez, "Microgreens Production with Sure tu Grow Pads," 2006.
[10] A. Handreck and N.D. Black.,Growing Media For ornamental Plants and Turf. *University of New South Wales Press Randwick NSW*.Australia, 1994.

[11] M. Nazir, Research methods. Bogor: Ghalia Indonesia, 2003.
[12] Sri. Anggrahini, "The Effect of Germination Time on the Content of α-Tocopherol and Proximate Compounds of Mung Bean Sprouts (Phaseolus radiatus L.*)*,"*Agritech Journal*, vol. 27(4), pp. 152–157, 2007.
[13] H. Thaheer and DS Hasibuan, *Fruit Juice Drink Industry*. 2014.
[14] Fitriyono. Ayustaningwarno, Food Technology Practical Theory and Applications. Yogyakarta: Graha Ilmu, 2014.
[15] T. Susanto, "Determining effectiveness tests on food ingredients,"*Brawijaya University Malang. Poor*, 2000.
[16] N. Gowda, K. Siliveru, PVV Prasad, Y Bhatt, BP Netravati, and C Gurikar., "Modern processing of Indian millets: perspectives on changing nutritional properties.,"*Food Journal*, vol. 11, no., 2022.
[17] Melia. Ariyanti and Wahyuni., "Flavonoid and Total Phenol Content in Fermented Cocoa Powder," pp. 76–79, 2019, [Online]. Available: www.kompas.co.id/
[18] Lina, "The effect of Vitamin C, Vitamin E, a combination of vitamin C and vitamin E on the stability of flavonoid levels in the ethyl acetate fraction of green tea leaf extract,"*Ekp*, vol. 13, no. 3, pp. 1576–80, 2015.
[19] RD Muktisari and FK Hartati, "Analysis of Antioxidant Activity in Black Rice and Black Rice Flour (Oryza sativa L.indica),"*Food Science and Technology Journal*, vol. 1, pp. 20–27, 2021.
[20] P. Molyneux, "The use of stable free radical diphenylpichrylhydrazyl (dpph) for estimating antioxidant activity..,"*Journal of Science and Technology,*vol. 26, no. 2, pp. 211–219, 2004.