
Antioxidant Activity and Organoleptic Quality of Probiotic Tepache of Pineapple Peel Sugar Variation and Fermentation Duration

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ABSTRACT

KEYWORDS:

Tepache
Pineapple peel
Antioxidant
Fermentation duration
Organoleptic

Tepache is a probiotic beverage from fermented product beneficial to health, which can improve the balance of good bacteria and reduce the risk of gastrointestinal disease. The content of honey pineapple peel includes carbohydrates 17.53 %, protein 4.41 %, reducing sugar 13.65 % and vitamins C and E which act as antioxidant. This research was aimed to determine the antioxidant activity and organoleptic quality of probiotics tepache beverage of pineapple peel with variation of sugar and fermentation duration. This research method used experimental and Complete Random Design (CRD) with two factors. The factor I was the type of sugar is 80 g granulated sugar (G1) and 80 g palm sugar (G2). Factor II was the fermentation duration in three days (F1) and five days (F2). The result showed that the highest antioxidant activity of pineapple peel tepache was 67.14 % in G2F1 (palm sugar + 3 days fermentation duration). The best organoleptic quality of pineapple peel tepache at G2F1 (palm sugar + 3 days fermentation duration) was brown color, sour taste, and slightly pineapple aroma.

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1. INTRODUCTION

Functional beverage involves bacteria whose role is to increase nutritional content and is a probiotic (Masengi et al. 2020). Functional beverages are gaining popularity because they provide benefits in the form of essential nutrients for the health of the body. Probiotics are believed to be able to produce antimicrobial compounds that can compete with pathogenic bacteria to prevent infection, particularly in the digestive tract (Rizal et al. 2020b). Tepache is one of the probiotic beverages that are advantageous to health.

Tepache is a traditional beverage of ancient Mexico consumed for centuries; different fruit peels can be used as substrates for tepache production (Ojeda-Linares et al. 2021). Tepache contains beneficial microorganisms that can produce anti-pathogen compounds such as lactic acid, hydrogen peroxide, and bacteriocins. *Honey pineapple peel* is a substrate that can be used to make tepache. Currently, tepache is beginning to be produced on a large scale for personal consumption or commercial purposes and can serve as an alternative for lactose-intolerant individuals (Oak and Jha 2019)

Honey pineapple peel has an uneven texture and small spines on its outer surface, including vitamins C and E, carotenoids, and flavonoids (Erukainure et al. 2018). According to (Kusuma et al. 2019), pineapple peel contains 81.7 % water, 17.53 % carbohydrates, 4.4 % protein, 13.65 % reducing sugar, and 20.87 % crude fiber. The content of flavonoids, saponins, and tannins can form antibacterial aromatic hydroxyl groups (Tivani and Sari 2021). Due to its high sucrose and carbohydrate content, honey pineapple peel has the potential to be used as a fundamental ingredient in processed fermented probiotics (Rizal et al. 2020a).

Sugar serves an essential function in the production of tepache as a nutrient source for

bacterial activity during the fermentation process (Rochani et al. 2016). Granulated and palm sugar are readily available sugar varieties with distinct compositions and production processes. (Iskandar et al. n.d.) Palm sugar is produced from palm juice that is cooked to a liquid state and then chilled to form granules. Palm sugar contains 85 % sucrose, 0.53 % reducing sugar, 2.28 % protein, 1.37 % calcium, and 1.37 % phosphor (Fatimah et al. 2019).

Granulated sugar contains 72 % sucrose, 3.7 % reducing sugar, 0.06 % protein, 1.64 % calcium, and 0.06 % export (Fatimah et al. 2019). The water content of palm sugar and granulated sugar differs, with palm sugar containing 10 % water and granulated sugar containing 0.02 % (USDA 2019 in Food Data Central ID343930). The presence of sugar in the substrate influences the duration of the fermentation process, which continues until the substrate's sugar content is depleted (A'yuni et al. 2020). The greater the concentration of sugar compounds in the substrate, the more significant the proportion of disaccharide compounds transformed into monosaccharides and glucose.

There is no involvement of starter-shaped microorganisms in the spontaneous fermentation that occurs during the production of tepache. However, microorganisms can be active because environmental factors support their growth. At the same time, the presence of sucrose encourages the growth of lactic acid bacteria in tepache products (Setiarto 2020). As long as sugar is still present, the fermentation process will continue (Rochani et al. 2016), and the more fermentation duration influences the decrease in pH value in fermentation results due to the presence of volatile acidic compounds resulting from the conversion of sugars. The variation in fermentation duration between the samples led to different antioxidant activities.

Antioxidants are compounds found in all plant parts, including stems, leaves, flowers, and fruits, that aid in overcoming oxidative damage caused by free radicals or reactive oxygen compounds (Saefudin et al. 2013). Honey pineapple peel is an antioxidant-rich fruit because of vitamins C and E (Rizal et al. 2020a). During fermentation, the type of sugar and duration of fermentation influence the antioxidant activity. In the research (A'yuni et al. 2020), it was discovered that differences in fermentation duration in samples led to an increase in antioxidant activity. Due to the length of fermentation, the flavonoid components in the wine have a greater antioxidant capacity. In addition, (Choong et al. 2016) compared the antioxidant activity of palm sugar and granulated sugar and found that palm sugar has an antioxidant activity of 28.88 % while white sugar has only 0.16 %. According to research (Hujjatusnaini, 2022), sucrose increased total lactic acid bacteria and pH. However, it decreased overall taste favorability, color, and acceptance scores, but not fragrance, in probiotic beverages made with pineapple peel extract. This research objective was to determine the antioxidant activity and organoleptic quality of probiotic beverages tepache of pineapple peel on variations of sugar and fermentation duration.

2. MATERIALS AND METHODS

1.1. Materials and Methods

The research involved is experimental. This research design used Complete Randomized Design with two treatment factors of sugar type (80 g of palm sugar and 80 g of granulated sugar) and fermentation durations (3 days and 5 days), with three sample repetitions/ treatment. Three hundred grams of pineapple peel, 80 g of sugar, and 350 ml of aquades used in this research. This experiment was conducted at the University of Muhammadiyah Surakarta's Biological Laboratory, Faculty of Teacher Training and Education, for making tepache and organoleptic quality. The antioxidant activity test was conducted at the Chem-Mix Pratama Bantul-Yogyakarta Laboratory.

2.1.1 Research Procedure

This research begun by sterilizing all instruments utilized during the tepache sample collection procedure. Then, the ingredients, including pineapple peel, sugar, and equivalents, were prepared. 80 g of palm sugar and 80 g of granulated sugar were dissolved in simmering water prior to creating tepache. The production of tepache begun by placing all ingredients in a glass container and preserving them at ambient temperature for between three and five days, depending on the fermentation duration. After harvesting, pH measurements, antioxidant activity testing with the DPPH (2,2-diphenyl-1-picrylhydrazyl) method, and organoleptic quality tests with 15 panelists were conducted.

2.1.1.1 Data analysis

The results of a research were presented in tabular format. Analysis of antioxidant quantitative descriptive methods with Kruskal wallis analysis test. Evaluation of antioxidant activity using DPPH reagents. The Radical Scavenging Activity (RSA) equation calculates a substance's free radical inhibiting activity:

$$\text{DPPH RSA (\%)} = \frac{\text{OD}_{\text{working fluid}} - \text{OD}_{\text{sample}}}{\text{OD}_{\text{working fluid}}} \times 100\%$$

The organoleptic test utilized quantitative descriptive analysis based on questionnaires distributed to 15 panelists, which included color, flavor, aroma, and acceptability then analyzed using Microsoft excel.

3 Results and Discussion

3.1 Result

According to the pH test results and antioxidant activity of tepache with variations in sugar types and fermentation duration (Table 3.1).

Tabel 3.1. The Result of Antioxidant Activity of Honey Pineapple Peel Tepache with Variations in Sugar Types and Fermentation Duration

No.	Treatments	Antioxidant Activity	pH
1	G1F1 (80 g granulated sugar + 3 days fermentation)	54.42 %	3.2
2	G2F1 (80 g plam sugar + 3 days fermentation)	67.14 %*	3.4
3	G1F2 (80 g granulated sugar + 5 days fermentation)	51.87 %**	3.0
4	G2F2 (80 g plam sugar + 5 days fermentation)	61.90 %	3.2

Notes: *) Highest score

***) Lowest score

Tabel 3.1 showed the G2F1 treatment (80 g palm sugar with a 3-day fermentation duration) produced the highest antioxidant activity (67,14 %) while the G1F2 treatment (80 g granulated sugar with a 5-day fermentation duration) produced the lowest antioxidant activity (51,87 %).

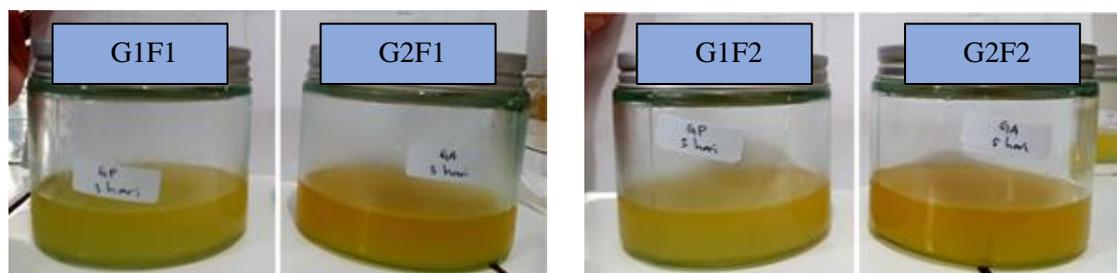


Figure 3.1 Organoleptic Quality of Honey Pineapple Peel Tepache with Variation of Sugar Types and Fermentation Duration.

Notes:

G1F1 : 80 g granulated sugar and 3- days fermentation duration

G2F1 : 80 g plam sugar and 3- days fermentation duration

G1F2 : 80 g granulated sugar and 5- days fermentation duration

G2F2 : 80 g plam sugar and 5- days fermentation duration

Tabel 3.2. Organoleptic Test Result of Honey Pineapple Peel Tepache at Variations of Sugar Types and Fermentation Duration.

No.	Treatments	Organoleptic			
		Color	Flavor	Aroma	Acceptability
1	G1F1	Slightly yellow	Much Sour	Slightly flavorful	Not like much
2	G2F1*	Brown	Sour	Slightly flavorful pineapple	Like
3	G1F2	Slightly yellow	Sour	Slightly flavorful pineapple	Not like much
4	G2F2	Brown	Sour	Slightly flavorful pineapple	Not like much

Notes: *) The highest organoleptic quality

Tabel 3.2 showed the G2F1 treatment (80 g of palm sugar and three days of fermentation) produced the highest organoleptic quality of pineapple peel tepache was brown color, sour flavor, and faint pineapple aroma).

3.1.1 Discussion

Tabel 3.1 shows that the antioxidant activity of tepache probiotic beverages with varying sugar types and fermentation durations based on the four treatments. The results of treating palm sugar varieties fermented for three days and five days, respectively, were 67.14 % and 61.94 %. In treating granulated sugar varieties fermented for three and five days, respectively, 54.42 % and 51.87 % yielded good results. Tepache treated with G2F1 (80g palm sugar fermented for three days) has the highest antioxidant activity of 67.14 %, whereas G1F2 (80g granulated sugar fermented for five days) had the lowest antioxidant activity of 51.87 %. The more fermentation durations, the lower antioxidant activity of tepache. Pineapple peel contains 38.95 mg/100 g of total antioxidants and 24.40 mg/100 g of bioactive components in vitamin C (Mardalena et al. 2015). As fermentation duration increases, vitamin C can be degraded, resulting in a decrease in antioxidant activity. This research, supported by (Sutedjo and Nisa 2015) explains that

microorganisms oxidize vitamin C (ascorbic acid) to L-dehydroascorbic acid, which then endures further changes to L-diketogulonate, which does not contain active vitamin C.

Adding palm sugar effect to result in more significant antioxidant activity than adding granulated sugar. Antioxidant activity with palm sugar type treatment and fermentation durations of 3 and 5 days yielded 67.14 % and 61.90 % results. In contrast, antioxidant activity with granulated sugar type treatment and fermentation durations of 3 and 5 days yielded 54.42 % and 51.82 % results because palm sugar has a more considerable antioxidant activity than granulated sugar, which has an activity of 0.16 %. In addition, palm sugar has a distinctively higher content than granulated sugar, with 85 % sucrose, 0.53 % reducing sugar, 2.28 % protein, 1.37 % calcium, and 1.37 % phosphor. In contrast, granulated sugar contains 72% sucrose, 3.7% reducing sugar, 0.06 % protein, 1.64 % calcium, and 0.06 % phosphor (Fatimah et al. 2019).

Based on the results of organoleptic quality, including color, aroma, flavor, and acceptability of probiotic beverages tepache pineapple peel with variations on sugar varieties and fermentation duration, as determined by 15 panelists, the following data was gathered:

1. Color

The G2F1 treatment (80 g of palm sugar fermented for three days) yields the maximum color quality (brown color). Throughout the fermentation process, the tepache changes color. According to research (Puji Astuti et al. 2020), the pigment of the sample will change as the fermentation duration increases. The color of the epidermis of the pineapple, which was initially bright yellow, changed to a yellow-brown color. Adding palm sugar to the brown G2F1 treatment can also alter the color of the tepache, causing a change in color.

2. Flavor

The G2F1 treatment (80 g of palm sugar fermented for three days) results in the highest flavor quality. Due to its high pH level, tepache possesses a sour flavor. According to research (Hujjatusnaini 2022), the sour flavor of a product results from a decrease in pH value and an increase in lactic acid.

3. Aroma

The G2F1 treatment (80 g of palm sugar fermented for three days) produces the finest aroma. According to (Hujjatusnaini 2022), adding sugar to tepache does not significantly alter its aroma. Due to the increase in alcohol content, however, a 5-day fermentation duration affects the aroma. According to the research (Puji Astuti et al., n.d.), panelists' interest was diminished due to the presence of compounds such as alcohol and acids during the fermentation process, which rendered the aroma objectionable.

4. Acceptability

The G1F2 treatment (80 g palm sugar fermented for three days) yielded the highest acceptability, which has a good acceptability. According to (Hujjatusnaini 2022), organoleptic testing, including color, flavor, and aroma, is crucial for the primary characteristics of a product that determine the panelists' attraction to a product.

3. CONCLUSIONS

The highest antioxidant activity of pineapple peel tepache was 67.14 % in G2F1 (palm sugar + 3 days fermentation duration) and the best organoleptic quality of pineapple peel tepache in G2F1 (palm sugar+ 3 days fermentation) was brown color, sour taste, and slightly pineapple aroma.

4. ACKNOWLEDGMENTS

The authors thank the Biology Education Department of Muhammadiyah Surakarta University for providing financial support for the INCOBEST conference.

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