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Preference of the Mouthwash Ingredients Wild Cosmos Leaf Extract (*Cosmos Caudatus*) among Organoleptic Test Panelists

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Abstract
Kenikir leaves are one of the traditional medicines used in Indonesia, yet only some studies investigate the compounds tested against them. This study aimed to evaluate Kenikir leaves as mouthwash with organoleptic tests and determine the differences in preferences. This type of research is quasi-experimental. The sample size is 32 people as organoleptic test panelists. The parameters were the color, smell, and taste of Kenikir leaf extract mouthwash material with original, mint, and mixed fruit flavors with a hedonic scale with ethnic groups of Jawa, Flores, Lombok, Bali, and Timor. The study results showed that regarding the color, the panelists preferred the mixed fruit color, with a $p = 0.032$ ($p < 0.05$). Regarding the smell, the panelists preferred the mixed fruit with $p = 0.019$ ($p < 0.05$). The panelists preferred the taste of mouthwash ingredients with mint flavor, but the assessment difference was insignificant at $p = 0.276$ ($p > 0.05$). Timor people like the product most. Meanwhile, the Flores ethnic group hardly likes all mouthwash products with Kenikir leaf extract. In conclusion, most preferred organoleptic test panelists of mouthwash ingredients are mouthwash ingredients with mixed fruit aroma/smell, color, and mint flavor.

Keywords: Organoleptic Test, Panelist, Mouthwash, Kenikir (*Cosmos Caudatus*)

1. Introduction

Plaque contains many bacteria, and inflammation can occur in the gingival tissue (Murakami et al., 2018). Gingivitis is caused by deposits of microbial plaque, usually in or near the gingival sulcus. Maintaining oral hygiene is of utmost importance to stop the progression of the disease. Plaque control is one of the most integral methods to control bacterial growth. Mechanical plaque control is the primary method for removing and controlling plaque, and toothbrushing plays a significant role. (Balan et al., 2018; Preethi & Ramamurthy, 2015).

About 80% of people around the globe rely on traditional medicine. As many as 170 of the 194 WHO Member States have reported using conventional medicine. Most Indonesians, especially in rural areas, also use traditional herbal medicines. Kenikir, known as the wild cosmos or *Cosmos caudatus*, is one of the vegetables Indonesians often consume. This is because the kenikir is an herbal plant that benefits human health. Research shows that Kenikir leaves extracted using ethanol and other solvents showed the presence of active compounds flavonoids, saponins, alkaloids, tannins, and polyphenols (Utami et al., 2024). Research also shows that kenikir leaves contain alkaloids, triterpenoids, phenolics, quinones, and flavonoids by phytochemical screening by methanol extract. Meanwhile, the ethanol extract contains flavonoids, saponins, phenolics, alkaloids, and quinones (Masitah et al., 2023; Phong et al., 2022).

Organoleptic testing is an evaluation that relies on the sensory perception process. This sensing process is described as a physio-psychological activity involving the awareness or recognition of an object's characteristics due to sensory stimulation from the object. Measurement of assessment using the five human senses is also called sensory assessment and is subjective. Organoleptic assessment requires a panel of people or groups to assess the quality of the product. The assessment usually takes the subjectivity of impressions (Damaziak et al., 2019; Sipos et al., 2021). People who are panel members are called panelists. Although traditional medicine has been used for a long time, it is not completely safe because it is a strange compound to the body, so it is very important to know its potential toxicity. Toxic effects on living things can be seen and may not be if the dose absorbed is relatively tiny. The damage can be limited to cells only (Aydın et al., 2016; Mihafu et al., 2020; Quintanilla-Casas et al., 2020).

This research aims to investigate the preference of panelists for the organoleptic test towards kenikir extract as a mouthwash.

2. Method

This quasi-experimental study of organoleptic testing was conducted with a post-test-only design without a control group design. The population of panelists are several Indonesian ethnic groups, namely Javanese, Flores, Lombok, Balinese, and Timorese, who lived in Denpasar City and its surroundings and came to fulfill the invitation to get an explanation before being selected as untrained panelists. The sample size in this study was 32 people, with an equal number of men and women. Samples of mouthwash extract from kenikir leaves were provided to panelists randomly, and the panelists' booth was also provided randomly.

The inclusion criteria include male or female adults aged between 20-35 years, 1) Male or female adults aged between 20-35 years, able to read and write, serious, open, and honest, healthy, and not suffering from illnesses that can influence the vision, smell, and taste. Meanwhile, the sample exclusion criteria are those who do not heed the prohibitions required during the study, are absent during the survey, resigning after completing the informed consent.

The data collection was for the color, smell, and taste of the kenikir leaf extract mouthwash using a hedonic scale with five measurement digits, namely: Strongly like (5), Like (4), Neutral/Neither Agree nor Disagree (3), Dislike (2) Strongly Dislike (1). Each panelist was given an assessment sheet in the form of a checklist.

The research was performed first by preparing kenikir leaf extract and producing it as a mouthwash. Later, the researchers looked for volunteers who were willing to be untrained panelists. Once the volunteers or the samples were obtained, an informed consent was signed. An interview was also performed with volunteers with questions and answers to determine their background and health conditions. The panelist selection stage was carried out based on intuition and rationality toward the sensitivity and knowledge of prospective panelists. Besides, the preparation of the tasting room and its completeness were also accomplished.

The collected assessment data were analyzed univariately, namely descriptive tests to determine the frequency and percentage, and then the differences in data between groups were tested using the Kruskal Wallis test.

3. Results

The results of the Kruskal-Wallis test of the panelists' organoleptic assessment of the color, smell, and taste of the mouthwash material made from kenikir leaf extract with various flavors are presented in Table 1.

Table 1: Mouthwash evaluation from the color, smell, and taste

No.	Mouthwash evaluation parameter	Flavor	n	Mean Rank	X^2	df	p-value
1.	Color	Original		42.84			
		Mint	32	44.28	6.883	2	0.032
		Mixed fruit		58.36			
2.	Smell	Original		39.17			
		Mint	32	48.89	7.931	2	0.019
		Mixed fruit		57.44			
3.	Taste	Original		45.06			
		Mint	32	54.70	2.573	2	0.276
		Mixed fruit		45.73			

Table 1 shows that the panelists most liked mixed fruit colors. The result of p-value is 0.032 ($p < 0.05$). The smell parameter got the same result that mixed fruit color dominates with a p-value of 0.019 ($p < 0.05$). Meanwhile, for the taste, the panelists prefer the mint flavor to mixed fruit and original flavors, with a p-value of 0.276 ($p > 0.05$).

Table 2: Assessment based on color with the Kruskal-Wallis test

Parameter	Flavor	Ethnic Group	n	Mean Rank	X^2	df	p-value
Color	*Original*	Jawa	6	12.83			
		Flores	6	15.50			
		Lombok	6	9.42	9.736	4	0.045
		Bali	6	22.50			
		Timor	8	21.81			
	Mint	Jawa	6	15.92			
		Flores	6	15.25			
		Lombok	6	11.33	4.048	4	0.400
		Bali	6	21.00			
		Timor	8	18.38			
	Mixed Fruit	Jawa	6	18.08			
		Flores	6	10.08			
		Lombok	6	16.00	5.696	4	0.223
		Bali	6	16.08			
		Timor	8	20.81			

Table 2 shows that the Balinese liked the original flavor color the most, with a p-value of 0.045. Meanwhile, for mint, the Balinese also liked it the most, with a p-value of 0.400. However, in the mixed fruit, Timorese liked the most compared to other ethnic groups, with a p-value of 0.223.

Table 3: Assessment based on smell with the Kruskal-Wallis test

Parameter	Flavor	Ethnic Group	n	Mean Rank	X^2	df	p-value
Smell	*Original*	Jawa	6	14.83			
		Flores	6	12.33	4.448	4	0.349
		Lombok	6	14.67			
		Bali	6	17.17			
		Timor	8	21.75			
	Mint	Jawa	6	21.00			
		Flores	6	12.50	3.195	4	0.526
		Lombok	6	15.92			
		Bali	6	15.00			
		Timor	8	17.69			
		Jawa	6	20.17			

	Mixed Fruit	Flores	6	11.33	6.668	4	0.155
		Lombok	6	18.92			
		Bali	6	12.25			
		Timor	8	19.00			

Table 5 shows no significant difference in preference because the p-value is more than 0.05 i.e. 0.349, 0.526, and 0.155.

Table 4: Assessment based on taste with the Kruskal-Wallis test

Parameter	Flavor	Ethnic Group	n	Mean Rank	X^2	df	p-value
Taste	Original	Jawa	6	16.33	4.776	4	0.311
		Flores	6	13.67			
		Lombok	6	15.17			
		Bali	6	13.67			
		Timor	8	21.88			
	Mint	Jawa	6	18.00	2.376	4	0.667
		Flores	6	12.33			
		Lombok	6	15.00			
		Bali	6	17.00			
		Timor	8	19.25			
	Mixed Fruit	Jawa	6	16.83	10.850	4	0.028
		Flores	6	10.00			
		Lombok	6	14.33			
		Bali	6	13.67			
		Timor	8	24.88			

Table 4 shows no significant difference in preference between ethnic groups regarding the taste of flavored mouthwash ingredients with p-values of 0.311, 0.667, and 0.028 respectively for original, mint, and mixed fruit flavors.

Table 5: Preference of panelists in organoleptic tests of mouthwash products with various flavors

No.	Experiment	n	Mean Rank	X^2	df	p-value
1.	Color in original flavor	32	290.80	98.951	17	0.000
2.	Color in mint flavor		296.17			
3.	Color in mixed fruit flavor		366.34			
4.	Smell in original flavor		318.28			
5.	Smell in mint flavor		383.09			
6.	Smell in mixed fruit flavor		432.02			
7.	Taste in original flavor		275.09			
8.	Taste in mint flavor		334.38			
9.	Taste in mixed fruit flavor		282.11			

Table 5 shows that the most preferred mouthwash product for its smell and color is a mixed fruit and mint flavors. Meanwhile, for the taste, the panelists prefer mint and mixed fruit flavors. The difference in this assessment is significant at $p = 0.000$ ($p < 0.05$).

4. Discussion

Researchers have widely used the hedonic test to measure the product level. Six levels are used in hedonic measurement, i.e., strongly like, like, somewhat like, neutral, dislike, and strongly dislike. This test is also widely used to evaluate final products. A hedonic scale can be used to determine differences in practice. Hedonic tests require a certain number of panelists (Gusti Agung Ayu Hari Triandini & Gde Adi Suryawan Wangiyana, 2023; Zuhdi & Khairi, 2022).

The results of the descriptive test in this study showed that for the mouthwash material of kenikir leaf extract, most panelists, namely 34.4% and 53.1%, stated that they strongly liked the color of the mouthwash material, while

40.6% stated that they neutral about the color of the mouthwash material. The results show that regarding the color, the panelists prefer the mixed fruit to mint and original flavors. The difference in the evaluation indicates significance with a $p = 0.032$ ($p < 0.05$). This shows that the organoleptic test panelists preferred the color of the mouthwash material with mixed fruit flavor over other flavors.

The evaluation of the smell parameter shows that most panelists (34.38%, 46.88%, and 62.5%) said they strongly like mouthwash with original, mint, and mixed fruit flavors. Only a tiny portion, namely 3.13%, 3.13%, and 0% stated they strongly dislike the smell of the kenikir leaf extract mouthwash. The panelists' assessment of the smell of the mouthwash showed that they prefer the smell of the mouthwash with mixed fruit flavor. The difference result is significant at $p = 0.019$ ($p < 0.05$). These results indicate that the panelists preferred the smell of the mouthwash with mixed fruit flavor to the others, and this difference in preference was significant at $p < 0.05$.

A neutral evaluation was obtained when the panelists assessed the taste of the mouthwash, in detail 56.25% of respondents. However, for the mouthwash with mint and mixed fruit flavors, the majority of panelists, namely 34.38% and 31.25%, said they strongly liked the taste. The analysis shows that the organoleptic test panelists preferred the taste of the mouthwash with mint flavor, mixed fruit, and original flavors, respectively. However, the assessment difference is insignificant at $p = 0.276$ ($p > 0.05$). These results indicate that panelists prefer the mouthwash's taste with mint flavor to the others.

The results of the organoleptic assessment based on the ethnic groups' preference for the color of the original mouthwash show that the Balinese prefer the color of the original mouthwash, followed by the Timor, Flores, Java, and Lombok groups. This difference in preference is significant with a $p = 0.045$ ($p < 0.05$). In the assessment of preference for mouthwash with mint and mixed fruit flavors between the ethnic groups, there is no significant difference with a value of $p = 0.400$ and $p = 0.223$ ($p > 0.05$).

The result data on the parameter of smell present no significant difference in preference. The same results were also obtained in the preference for ethnic groups. The Kruskal-Wallis test expresses that the most preferred mouthwash product is a mouthwash with mixed fruit and mint based on smell and color.

The findings of this study indicate that the mouthwash formula made from kenikir leaf extract could serve as a herbal product in the country, aligning with the "back to nature" approach. This method allows for the incorporation of various herbal ingredients as antimicrobial agents in different cosmetic products, including mouthwash. Given that the use of herbal medicines in the world continues to increase, as well as in Indonesia, it is expected that drug manufacturers will be interested in continuing to develop herbal medicines, especially kenikir leaf extract (Ahmed et al., 2023; Chaachouay & Zidane, 2024; Rahayu et al., 2020). The results of this study describe organoleptic test panelists' preference for mouthwash products with kenikir leaf extract. The most preferred mouthwash formula is a formula with mint and mixed fruit flavors so that it can be used as a reference if this formula is to be developed into a product with economic value.

It is recommended for future research to conduct similar research with an interview with panelist regarding their habits of using other brands of mouthwash with similar flavors, such as mint and mixed fruit. This will affect the panelists' assessment of the mouthwash and toothpaste products with kenikir leaf extract because the subjective and psychological reactions of the panelists also influence the organoleptic evaluation. Several of these panelists stated that the mouthwash product, especially with the original flavor, felt sticky on the tongue and tasted bitter, so people rarely prefer it.

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