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NUTRITIONAL VALUE, SUGAR CONTENT, ACIDITY, FIBER CONTENT, TOTAL BACTERIA, AND ACCEPTABILITY OF MIXED FRUIT KEFIR AND MILK FRUIT KEFIR

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Abstract

Kefir is a probiotic-rich functional beverage, and the addition of fruit enhances its nutritional composition, sensory characteristics, and consumer acceptability. This study analyzed twelve types of mixed fruit kefir and milk-based fruit kefir, focusing on nutritional value, sugar content, acidity, fiber levels, total bacterial count, and acceptability. The results showed that energy content ranged from 29.4 to 78.2 kcal per 100 grams, with mango kefir (50%) having the highest energy value. Protein content varied from 1.5% to 2.5%, with banana milk kefir (30%) containing the highest amount. Sugar content ranged from 1.6% to 12.6%, while acidity levels varied from 1.0% to 1.8%, influencing taste and microbial stability. Fiber content ranged from 1.2% to 3.4%, and total bacterial count varied between 26,666,667 and 2,247,000,000 CFU/g, confirming kefir's probiotic potential. Sensory analysis revealed that mango kefir (50%) and dragon kefir (50%) were the most preferred, while banana kefir (30%) had the lowest acceptability. These findings suggest that fruit-based kefir formulations can optimize both nutritional value and sensory appeal, positioning kefir as a highly nutritious and functional beverage.

Keywords : *Functional Food, Kefir, Nutritional Value, Probiotics, Sensory Evaluation*.

1. Introduction

Kefir, a fermented milk product made by inoculating milk with kefir grains, has gained popularity as a functional food with remarkable health benefits. This unique drink, rich in probiotics, vitamins, minerals, and essential amino acids, is known for its ability to improve gut microbiota balance and strengthen the immune system (Azizi et al., 2021). Beyond being a refreshing beverage, kefir has been extensively studied for its role in preventing non-communicable diseases (NCDs) such as cardiovascular issues, obesity, and diabetes (Wijaningsih et al., 2024). As people become more health-conscious, the demand for nutritious, natural, and probiotic-rich foods like kefir continues to rise.

One of the most exciting developments in kefir-based products is its combination with fruits, creating a synergy between probiotics and the natural goodness of fruit. Fruits not only enhance the flavor of kefir but also boost its nutritional value by adding fiber, antioxidants, and natural sugars. This combination makes kefir a more appealing option for those seeking both taste and health benefits. Research has shown that mixed kefir fruit and milk-based fruit kefir contain varying levels of energy, ranging from 29.4 to 78.2 kcal per 100 grams, with mango kefir (50% concentration) providing the highest energy content and watermelon kefir (30% concentration) the lowest. Additionally, the protein content in these kefir variations ranges from 1.5 to 2.5%, with banana-based kefir having the highest protein concentration (Wijaningsih et al., 2024). These findings highlight the potential of fruit-infused kefir as a nutritious alternative to conventional dairy products.

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Moreover, kefir offers a significant advantage for individuals with lactose intolerance. The fermentation process reduces lactose levels, making it easier to digest while still providing essential nutrients (Hardiansyah, 2020). Probiotics such as *Lactobacillus fermentum*, *Lactobacillus acidophilus*, and *Lactobacillus kefiri* help maintain a healthy gut microbiota and improve digestive health (Wijaningsih et al., 2024). These beneficial microbes not only aid digestion but also produce bioactive peptides with antimicrobial and anti-inflammatory properties, further enhancing kefir's health-promoting effects. With its rich probiotic content and bioactive compounds, kefir is not just a drink but a powerful ally in maintaining overall well-being.

This study aims to explore the nutritional composition, sugar content, acidity, fiber levels, total bacterial count, and overall acceptability of mixed fruit kefir and milk-based fruit kefir. By analyzing these aspects, the research seeks to determine the most favorable formulation in terms of both nutritional value and consumer preference. Additionally, the study investigates the potential health benefits of kefir, particularly its role in managing cholesterol levels and weight in individuals with obesity. Through sensory evaluation, the study also aims to assess consumer acceptance and identify the most appealing variations of kefir (Wijaningsih et al., 2024). The ultimate goal is to provide scientific insights that can support the development of innovative, functional kefir-based products that cater to modern dietary needs.

As modern consumers shift towards healthier eating habits, functional foods like mixed fruit kefir and milk-based fruit kefir present a compelling alternative. Not only do they provide essential nutrients, but they also cater to evolving taste preferences, making them more appealing to a wider audience. The combination of kefir and fruit creates a product that is both delicious and beneficial for health, increasing its acceptance among consumers (Wijaningsih et al., 2024). With the continuous rise in demand for natural and probiotic-rich foods, further research into the formulation and optimization of kefir-based products is essential. By refining taste, texture, and nutritional composition, kefir could become a staple in modern diets, paving the way for a healthier future (Azizi et al., 2021).

2. Method

Design, location, and time

This study was conducted using an experimental research design to analyze the nutritional composition, sugar content, acidity, fiber levels, total bacterial count, and sensory acceptance of mixed fruit kefir and milk-based fruit kefir. The experiment involved two main formulations: (1) Mix Kefir Buah (mixed fruit kefir), where ready-made kefir was combined with different types of fruits, and (2) Kefir Susu Buah (milk-based fruit kefir), where fruit was mixed with milk before undergoing the fermentation process. Each formulation was prepared with three concentration levels: 10%, 30%, and 50% fruit content.

The study was carried out in Semarang, Indonesia, in November 2023. Laboratory analyses were conducted to determine the nutritional values, including proximate composition (energy, protein, fat, carbohydrate, moisture, and ash content), fiber levels, total bacterial count, sugar content, and acidity of the kefir samples. Additionally, a sensory evaluation was performed to assess consumer acceptance based on taste, color, aroma, and texture (Wijaningsih et al., 2024). This research received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Semarang with approval number 0815/EA/KEPK/2024.

Sampling

A purposive sampling method was used to select fruit types based on their nutritional composition and potential compatibility with kefir. The selected fruits included dragon fruit, pineapple, orange, banana, watermelon, avocado, pear, strawberry, grapes, guava, and mango. These fruits were chosen due to their varying sugar content, acidity, and fiber levels, which were expected to influence the final characteristics of the kefir (Wijaningsih et al., 2024).

For sensory evaluation, panelists were recruited using a convenience sampling approach, comprising individuals familiar with dairy products and probiotic beverages. The panelists consisted of male and female participants from various age groups between 17 and 30 years old, with 25 panelists who had been trained.. The evaluation was conducted using a 9-point hedonic scale, where panelists rated their

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preference for taste, aroma, texture, and overall acceptance of each kefir formulation (Wijaningsih et al., 2024).

Data collection

Preparation of Kefir Samples

The kefir grains were obtained from an online supplier and cultivated in sterilized milk at a 50 g per 1000 mL ratio. Fermentation was carried out for 24 hours to produce a liquid kefir starter. The prepared kefir was then used in two different formulations :

1. Mix Kefir Buah – The fruit was blended and mixed with pre-fermented kefir at concentrations of 10%, 30%, and 50%. Kefir that has been pre-fermented by mixing kefir grains, which are then incubated at a ratio of 50 grams of kefir grains per 1000 ml of sterilized milk. The fermentation process takes 24 hours to produce kefir that is ready for consumption.
2. Kefir Susu Buah – The fruit was blended and mixed with milk before undergoing fermentation with kefir grains for 24 hours at 30°C. The final product was stored in a refrigerated environment before further testing (Wijaningsih et al., 2024).

Laboratory Analysis

Laboratory tests were conducted to determine the following parameters :

1. Proximate Analysis: Energy content, moisture, ash, protein, fat, and carbohydrate levels were analyzed using standard *Association of Official Analytical Chemists* (AOAC) methods.
2. Fiber Content: The total fiber content was measured using enzymatic-gravimetric methods.
3. Sugar Content: The sugar levels in kefir were analyzed using a refractometer.
4. Acidity (pH and Lactic Acid Content): pH levels were measured using a pH meter, while titratable acidity was determined using a standard titration method.
5. Total Bacterial Count: The number of Lactobacillus bacteria was quantified using the pour plate method, following microbiological standards (Wijaningsih et al., 2024).

Sensory Evaluation

The sensory evaluation was carried out with 25 trained panelists in a controlled sensory laboratory to ensure consistency and minimize external influences. Each kefir sample was coded using a random three-digit number to prevent bias and was served at a standardized temperature of 10–12 °C in randomized order to avoid sequence effects. Panelists were instructed to individually evaluate the samples based on four sensory attributes, namely taste, aroma, texture, and overall acceptability, using a 9-point hedonic scale where 1 represented "strongly dislike" and 9 represented "strongly like." All assessments were recorded on standardized evaluation sheets prepared beforehand, allowing for systematic data collection. The scores obtained from the panelists were then compiled and subjected to statistical analysis using analysis of variance (ANOVA) to identify significant differences among the kefir formulations. When significant differences were observed, post-hoc tests were applied to determine which formulations were most preferred. The results of this evaluation provided a clear indication of the kefir combination with the highest level of consumer acceptance, thereby serving as a basis for identifying the most favorable formulation (Wijaningsih et al., 2024).

Data analysis

The collected data were analyzed using statistical software. Descriptive statistics were used to summarize the proximate composition, sugar content, acidity, fiber levels, and total bacterial count. ANOVA (Analysis of Variance) and Duncan's multiple range test were applied to compare differences between kefir formulations and determine significant variations in nutritional values and sensory acceptance. Pearson correlation analysis was also conducted to examine relationships between kefir characteristics and sensory preference scores (Wijaningsih et al., 2024).

This methodological approach ensured that the study not only assessed the nutritional and microbiological aspects of kefir but also incorporated consumer perspectives, providing a comprehensive evaluation of mixed fruit kefir and milk-based fruit kefir as functional foods.

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3. Result and Discussion

Nutritional Value of Mixed Fruit Kefir and Milk-Based Fruit Kefir

Table 1. Analysis Results of Nutrient Content in Fruit Kefir and Milk Fruit Kefir

No	Type of Fruit Kefir	Energy (Cal/100 g)	Fat (Cal/100 g)	Ash Proportion	Water Proportion	Carbohydrate Proportion	Fat Proportion	Protein Proportion
1	Orange Kefir 50	62.6±2.69	8.9±2.53 ^{a}	0.5±0.00 ^{ab}	85.1±0.37	11.9±0.23 ^{a}	1.0±0.28 ^{a}	1.5±0.02 ^{a}
2	Mango Kefir 50	78.2±0.93	10.9±0.92 ^{ab}	0.4±0.02 ^{a}	81.6±0.25	15.3±0.16 ^{c}	1.2±0.10 ^{a}	1.5±0.01 ^{a}
3	Dragon Kefir 50	71.3±2.44 ^{b}	13.4±4.41 ^{b}	0.5±0.08 ^{b}	83.5±0.13 ^{a}	12.6±0.56 ^{a}	1.5±0.49 ^{ab}	1.9±0.29 ^{ab}
4	Pineapple Kefir 50	74.7±0.23	9.5±0.47 ^{ab}	0.5±0.02 ^{a}	82.3±0.14	14.8±0.12 c	1.1±0.05 ^{a}	1.5±0.09 ^{d}
5	Banana Kefir 30	69.2±2.24 ^{b}	12.4±0.94 ^{ab}	0.7±0.01 ^{c}	83.8±0.69 ^{a}	12.3±0.75 ^{a}	1.4±0.10 ^{a}	1.9±0.05 ^{d}
6	Watermelon Kefir 50	57.7±1.51	10.0±0.63 ^{ab}	0.4±0.02 ^{a}	86.5±0.29	10.4±0.19	1.1±0.07 ^{a}	1.5±0.03 ^{a}
7	Orange Milk Kefir 50	34.1±0.26	11.1±1.25 ^{ab}	0.5±0.01 ^{ab}	92.6±0.11	3.8±0.49 ^{b}	1.2±0.14^{a}	1.9±0.24^{d}
8	Mango Milk Kefir 30	47.2±1.19 ^{a}	17.7±1.52 ^{c}	0.5±0.02 ^{b}	90.1±0.20 ^{bc}	5.4±0.29 ^{cd}	2.0±0.17 ^{bc}	2.0±0.09^{bc}
9	Dragon Milk Kefir 50	44.6±2.73 ^{a}	17.0±2.84 ^{c}	0.6±0.02	90.7±0.55 ^{c}	4.9±0.68 ^{c}	1.9±0.32 ^{bc}	2.1±0.14 ^{bc}
10	Pineapple Milk Kefir 50	45.3±1.45 ^{a}	10.6±1.04 ^{ab}	0.4±0.03^{a}	89.7±0.52 ^{b}	7.0±0.67	1.2±0.12 ^{a}	1.6±0.06 ^{a}
11	Banana Milk Kefir 30	51.8±0.39	18.2±2.14 ^{c}	0.7±0.04 ^{c}	88.9±0.27	5.9±0.48 ^{d}	2.0±0.24 ^{c}	2.5±0.14 ^{c}
12	Watermelon Milk Kefir 30	29.4±3.60	12.8±1.72 ^{ab}	0.5±0.00 ^{ab}	93.5±0.25	3.4±0.66 ^{b}	1.1±0.57 ^{a}	1.6±0.22 ^{a}

Values aare means ± standard deviation, means with different superscripts along the same column are significantly different ($p < 0.05$) ; the superscript alphabets "a-f" separates the means obtained from ANOVA using Duncan's Multiple Range Test

Keys :

Kefir Pineapple 50 (50% kefr: 50%Pineapple), Kefir Susu Pineapple 50 (50% kefir: 25% Susu: 25% Pineapple), Kefir Dragon 50 (50% kefir: 50% Dragon). Kefir Susu Dragon 50 (50% kefir: 25% Susu 25% Dragon), Kefir Wo termelon 50 (50% kefir: 50% Wo temelon), Kefir Susu Watermelon 30 (30%kefir.35% Susu: 35% Wo termelon), Kefir Banana 30 (30% kefir: 70% Banana), Kefir Susu Banana 30 (30% kefir: 35% Susu: 35%Banana), Kefir Orange 50 (50%kefir: 50%Orange), Kefir Susu Orange 50 (50% kefir: 25% Susu: 25%Orange), Kefir Mango 50 (50% kefir: 50%Mango), Kefir Susu Mango 30 (30% kefir: 35% Susu: 35%Mango)

The nutritional value of kefir is a crucial aspect that determines its health benefits, functional properties, and suitability for diverse dietary needs. Kefir is well known for its probiotic content, high nutritional value, and ability to support digestive health. However, the addition of fruit can significantly alter its nutritional composition, affecting energy levels, macronutrient distribution, and overall consumer acceptability. The study analyzed twelve types of mixed fruit kefir and milk-based fruit kefir, evaluating key nutritional parameters such as energy, protein, fat, carbohydrate, moisture, and ash content (Wijaningsih et al., 2024).

1. Energy Content

Energy is an essential factor in assessing the nutritional contribution of kefir in daily diets. It plays a critical role in body metabolism, growth, temperature regulation, and physical activity (Najah & Nurhayati, 2018). The study found that the energy values ranged from 29.4 kcal to 78.2 kcal per 100 grams, with the lowest energy content in watermelon milk kefir (30%) and the highest in mango kefir (50%) (Wijaningsih et al., 2024). This variation is attributed to differences in carbohydrate and fat content among different fruit types.

Kefir serves as a functional food that provides energy while supporting digestive health. The balance between energy intake and expenditure is crucial in preventing metabolic disorders, making

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kefir a suitable dietary addition for weight management and energy replenishment (Najah & Nurhayati, 2018).

Additionally, kefir with moderate energy levels such as pineapple kefir (50%) (44.6–47.2 kcal per 100 grams) was found to be an ideal functional food option, offering a balance between calorie intake and nutritional benefits. Conversely, kefir formulations with lower energy content, such as watermelon kefir (30%), may be suitable for individuals seeking low-calorie fermented beverages.

2. Protein Content

Protein is vital for cell regeneration, muscle growth, and metabolic processes. The study found that protein content in kefir varied between 1.5% and 2.5%, with the highest concentration in banana milk kefir (30%) (Wijaningsih et al., 2024). The fermentation process enhances protein digestibility by breaking down complex proteins into peptides and amino acids, improving absorption (Rahayu et al., 2020).

The analysis confirmed that kefir contains essential amino acids such as lysine (376 mg/100 g), isoleucine (262 mg/100 g), and valine (220 mg/100 g) (Rosa et al., 2017). These amino acids support muscle function, immune response, and enzyme production, making kefir an ideal source of bioavailable protein for individuals with lactose intolerance (Dewi et al., 2021).

3. Fat Content

Fat content in kefir is primarily derived from the milk used in fermentation, with variations depending on the fruit type and concentration added. The presence of fat-soluble vitamins such as vitamins A, D, E, and K makes fat a crucial component of kefir's nutritional profile (Farag et al., 2020).

The study revealed that fat containt in kefir ranged from 1.1% to 2.0%, with the highest levels found in mango milk kefir (30%) and banana milk kefir (30%). The lowest fat levels were observed in orange kefir (50%) (Wijaningsih et al., 2024). This suggests that mango and banana contribute higher fat content due to their natural lipid composition (Maldonado-Celis et al., 2019).

During fermentation, fat metabolism by lactic acid bacteria enhances digestibility, resulting in a smoother texture and improved nutritional bioavailability. The presence of free fatty acids formed during fermentation is beneficial for gut health, lipid metabolism, and cardiovascular function (Prayoga et al., 2021).

4. Carbohydrate Content

Carbohydrates serve as the primary energy source in kefir, and their composition is largely influenced by the type of fruit added and the fermentation process.

The study found that carbohydrate levels ranged from 3.4% to 15.3%, with the highest content found in mango kefir (30%) and the lowest in watermelon kefir (30%) (Wijaningsih et al., 2024). Fruits naturally contribute simple sugars such as glucose and fructose, which serve as substrates for microbial fermentation (Yuan et al., 2024).

During fermentation, lactic acid bacteria break down lactose into lactic acid, reducing the overall sugar content while enhancing digestibility (Prayoga et al., 2021). This makes kefir a suitable dairy alternative for individuals with lactose intolerance, as the fermentation process significantly lowers lactose levels (Dahiya & Nigam, 2023).

5. Moisture and Ash Content

Moisture content influences the texture, taste, and shelf life of kefir. The study found that moisture levels ranged from 81.6% to 93.5%, with the highest values in watermelon milk kefir (30%) and the lowest in mango kefir (50%) (Wijaningsih et al., 2024). Higher moisture levels contribute to a more fluid texture, while lower moisture results in a thicker consistency (Ng et al., 2022).

Ash content, which indicates mineral composition, ranged from 0.4% to 0.7%, with the highest levels observed in banana kefir (30%) (Wijaningsih et al., 2024). Higher ash content suggests a greater presence of essential minerals such as calcium, magnesium, and potassium, which are crucial for bone health and metabolic regulation (Julianto et al., 2016).

Sugar Content in Mixed Fruit Kefir and Milk-Based Fruit Kefir

Sugar content is a critical component in kefir production, as it serves as the primary energy

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source for microbial fermentation (Matejčeková & Valík, 2025). The balance of sugar in kefir affects taste, acidity, microbial growth, and overall nutritional composition (Arroum et al., 2025). Naturally occurring sugars in milk and fruits undergo metabolic conversion during fermentation, resulting in lactic acid, ethanol, and carbon dioxide production (Mulyani et al., 2021).

Table 2. Test Results of Sugar Proportion, Acidity Proportion, Fiber Proportion, and Lactobacillus Content

No	Type of Fruit Kefir	Sugar Proportion	Acidity Proportion	Fiber Proportion	Lactobacillus pergram
1	Orange Kefir 50	9.7±0.93 $^{b\,e}$	1.4±0.02 ^{cd}	1.2±0.16 ^{b}	2247000000±37770000000
2	Mango Kefir 50	12.0±0.40 ^{f}	1.1±0.01 ^{b}	3.4±0.27	83333333±6806859 ^{a}
3	Dragon Kefir 50	10.8±0.54 ^{b}	1.1±0.06 ^{b}	2.6±0.34 ^{a}	37000000±34641016 ^{a}
4	Pineapple Kefir 50	12.6±0.07 ^{f}	1.6±0.02 ^{fg}	2.4±0.37 ^{a}	41000000±33451457 ^{a}
5	Banana Kefir 30	10.4±0.23 ^{b}	1.0±0.07 ^{a}	2.6±0.49 ^{a}	73333333±6658328 ^{a}
6	Watermelon Kefir 50	9.0±0.52 ^{e}	1.0±0.02 ^{a}	1.5±0.40 ^{bc}	26666667±6658328 ^{a}
7	Orange Milk Kefir 50	1.8±0.30 ^{c}	1.4±0.02 ^{c}	2.2±0.07 ^{acd}	396700000±453200000 ^{a}
8	Mango Milk Kefir 30	4.5±0.96 $^{a\,d}$	1.5±0.02 ^{ef}	2.3±0.17 $^{a\,d}$	96000000±81902381 ^{a}
9	Dragon Milk Kefir 50	3.4±1.53 ^{a}	1.5±0.08 ^{de}	1.5±0.62 ^{b}	28000000±1732051 ^{a}
10	Pineapple Milk Kefir 50	5.4±0.73 ^{d}	1.8±0.05	1.7±0.39 ^{bcd}	70333333±4932883 ^{a}
11	Banana Milk Kefir 30	3.8±0.83 ^{a}	1.6±0.07 ^{g}	2.4±0.09 ^{a}	149000000±66955209 ^{a}
12	Watermelon Milk Kefir 30	1.6±0.09 ^{c}	1.3±0.02	2.4±0.51 ^{a}	46666667±63508530 ^{a}

Values are means+standard deviation, means with different superscripts along the same column are significantly different ($p < 0.05$); the superscript alphabets "a-f" separates the means obtained from ANOVA using Duncan's Multiple Range Test
Keys:
Kefir Pineapple 50 (50% kefir: 50% Pineapple), Kefir Susu Pineapple 50 (50% kefir: 25% Susu: 25% Pineapple), Kefir Dragon 50 (50% kefir: 50% Dragon), Kefir Susu Dragon 50 (50% kefir: 25% Susu: 25% Dragon), Kefir Wotermelon 50 (50% kefir: 50% Wotermelon), Kefir Susu Wotermelon 30 (30% kefir: 35% Susu: 35% Wb termelon), Kefir Banana 30 (30% kefir: 70% Banana), Kefir Susu Banana 30 (30% kefir: 35% Susu: 35% Banana), Kefir Orange 50 (50% kefir: 50%Orange), Kefir Susu Orange 50 (50% kefir: 25% Susu: 25% Orange), Kefir Mango 50 (50% kefir: 50% Mango), Kefir Susu M ango 30 (30% kefir: 35% Susu: 35% Mango)

The study revealed that sugar content In kefir ranged from 1.6% to 12.6%, with the lowest sugar content in watermelon kefir (30%) and the highest in pineapple kefir (50%) (Wijaningsih et al., 2024).

1. Low-Sugar Kefir Variants: Orange milk kefir (50%) and dragon milk kefir (50%) contained 1.8%–3.4% sugar, making them ideal for individuals reducing sugar intake.
2. Moderate-Sugar Kefir Variants: Banana kefir (30%), mango milk kefir (30%), and pineapple milk kefir (50%) contained 3.8%–5.4% sugar, offering a balanced natural sweetness.
3. High-Sugar Kefir Variants: watermelon kefir (50%), orange kefir (50%), banana kefir (30%), and dragon fruit kefir (50%) had 9.0%–10.8% sugar, contributing to a sweeter taste profile.
4. Highest Sugar Content: Mango kefir (30%) had the highest 12.0% sugar content, attributed to mango's naturally high fructose and sucrose levels.

Fermentation involves microbial metabolism of sugar, where yeast and lactic acid bacteria break down sucrose into glucose and fructose. These simple sugars are converted into pyruvic acid, lactic acid, ethanol, and carbon dioxide, influencing taste, acidity, and texture (Adi Wira Kusuma et al., 2020).

While sugar enhances flavor, excessive consumption is associated with obesity, diabetes, and metabolic disorders. Hence, the formulation of low-sugar kefir options provides a healthier alternative to commercial sweetened beverages (Calcaterra et al., 2023).

Acidity in Mixed Fruit Kefir and Milk-Based Fruit Kefir

Acidity is a key determinant of kefir quality, influencing taste, microbial viability, and shelf life. The breakdown of lactose into lactic acid results in kefir's characteristic tangy flavor, which varies depending on fermentation duration and fruit composition (Sionek et al., 2023).

The study found that acidity levels ranged from 1.0% to 1.8%, with:

1. Lowest Acidity : Banana kefir (30%) and watermelon kefir (50%) (1.0% acidity), producing a milder, less tangy flavor.
2. Moderate Acidity : Mango kefir (50%) and dragon kefir (50%) (1.1% acidity), offering a balanced sourness.

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3. Highest Acidity : Pineapple kefir (50%) (1.8% acidity), attributed to pineapple's natural acid content and higher microbial activity (Wijaningsih et al., 2024).

Higher acidity acts as a natural preservative, preventing the growth of pathogenic bacteria and extending product shelf life (Anumudu et al., 2024). Additionally, acidic foods stimulate digestive enzyme production, enhancing nutrient absorption and gut health (Hardiansyah, 2020).

Fiber Content in Mixed Fruit Kefir and Milk-Based Fruit Kefir

Dietary fiber is an essential component for gut health, digestion, and metabolic regulation. The addition of fruit to kefir significantly increases dietary fiber content, making it a functional food for digestive health (Fairudz & Nisa, 2015).

The study found that fiber content In kefir ranged from 1.2% to 3.4%, with :

1. Lowest Fiber Content: Orange kefir (50%) (1.2%)
2. Moderate Fiber Content: Dragon fruit kefir (50%), pineapple kefir (50%), banana kefir (30%), orange kefir (50%), mango kefir (30%), and watermelon kefir (30%) (2.3%–2.6%)
3. Highest Fiber Content: Mango kefir (50%) (3.4%) (Wijaningsih et al., 2024)

Fiber-rich kefir enhances gut microbiota, regulates blood sugar, and promotes satiety, making it beneficial for weight management and metabolic health. However, fiber intake in Indonesia remains below the recommended 30 g/day, averaging only 9.9–10.7 g/day (Bellikci-Koyu et al., 2019).

Regular consumption of fiber-enhanced kefir may help bridge this dietary fiber gap, improving gut health and reducing obesity risks.

Total Bacteria in Mixed Fruit Kefir and Milk-Based Fruit Kefir

The presence of probiotic bacteria in kefir is one of its defining health benefits. Kefir contains Lactobacillus fermentum, L. acidophilus, L. helveticus, and L. casei, which contribute to gut microbiota balance and immune function (Rahayu et al., 2020).

The study found that Lactobacillus counts ranged from 26,666,667 to 2,247,000,000 CFU/g, with :

1. Lowest Bacterial Count: watermelon kefir (50%) (26,666,667 CFU/g).
2. Highest Bacterial Count: Orange kefir (50%) (2,247,000,000 CFU/g), attributed to higher acidity promoting microbial growth (Wijaningsih et al., 2024).

Probiotic-rich foods containing at least 10^7 CFU/ml of beneficial bacteria provide optimal gut health benefits (Prayoga et al., 2021). Regular consumption of kefir supports digestion, enhances nutrient absorption, and boosts immune function .

Acceptability of Mixed Fruit Kefir and Milk-Based Fruit Kefir

Table 3. Hedonic Test Results

No	Type of Fruit Kefir	Flavour	Viscosity	Taste	Colour	Overall
1	Orange Kefir 50	4.2±1.01 ^{bc}	3.2±0.65 ^{a}	4.6±0.70 ^{ef}	4.2±0.91 ^{abc}	4.0±0.36 $^{ab\ e}$
2	Mango Kefir 50	4.4±0.92 ^{c}	4.4±0.92	4.4±0.92 ^{def}	4.4±0.92 ^{ab}	4.4±0.92 ^{c}
3	Dragon Kefir 50	3.9±1.24 ^{abc}	3.9±0.83 ^{b}	4.2±0.76^{cde}	4.6±0.51 ^{b}	4.1±0.46 $^{b\ e}$
4	Pineapple Kefir 50	3.8±0.66 ^{ab}	3.5±0.82 ^{ab}	4.8±0.41 ^{f}	4.0±0.98 ^{acd}	4.0±0.36 ^{cde}
5	Banana Kefir 30	3.9±1.24 ^{abc}	3.8±0.72 ^{b}	3.3±1.03 ^{a}	3.7±0.56 ^{cd}	3.7±0.42 ^{abcd}
6	Watermelon Kefir 50	3.8±0.83 ^{ab}	3.4±0.96 ^{ab}	4.2±0.85 ^{cd}	4.2±0.82 ^{ab}	3.9±0.54 ^{abc}
7	Orange Milk Kefir 50	3.9±0.88 ^{abc}	3.4±0.87 ^{ab}	3.5±0.65 ^{ab}	4.1±0.70 ^{abc}	3.7±0.46 ^{abcd}
8	Mango Milk Kefir 30	3.5±0.65 $^{a\ d}$	3.5±0.65 ^{ab}	3.5±0.65 ^{ab}	3.5±0.65 ^{de}	3.5±0.65 ^{cd}
9	Dragon Milk Kefir 50	3.0±1.08 ^{d}	3.6±0.96 ^{ab}	3.6±0.51 ^{ab}	4.2±0.88 ^{ab}	3.6±0.57 ^{acd}
10	Pineapple Milk Kefir 50	3.8±0.85 ^{ab}	3.9±0.78 ^{b}	3.6±0.58 ^{ab}	4.0±0.76 ^{acd}	3.8±0.46 ^{abc}

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No	Type of Fruit Kefir	Flavour	Viscosity	Taste	Colour	Overall
11	Banana Milk Kefir 30	3.8±0.66 ^{ab}	3.2±0.94 ^{a}	3.1±1.00 ^{a}	3.2±0.94 ^{e}	3.3±0.38 ^{d}
12	Watermelon Milk Kefir 30	3.4±0.65 $^{a\,d}$	3.2±0.80 ^{a}	4.0±0.98 ^{bc}	4.2±0.83 ^{ab}	3.7±0.40 ^{abcd}

Values are maens standard deviation, means with different superscripts along the same column are significantly different ($p < 0.05$); the superscript alphabets "a-f" separates the means obtained from ANOVA using Duncan's Multiple Range Test
Keys :
Kefir Pineapple 50 (50% kefir: 50% Pineapple), Kefir Susu Pineapple 50 (50% kefir: 25% Susu: 25% Pineapple), Kefir Dragon 50 (50% kefir: 50% Dragon), Kefir Susu Dragon 50 (50% kefir: 25% Susu: 25% Dragon), Kefir Wotermelon 50 (50% kefir: 50% Wotermelon), Kefir Susu Wotermelon 30 (30% kefir: 35% Susu: 35% Wotermelon), Kefir Banana 30 (30% kefir: 70% Banana), Kefir Susu Banana 30 (30% kefir: 35% Susu: 35% Banana), Kefir Orange 50 (50% kefir: 50% Orange), Kefir Susu Orange 50 (50% kefir: 25% Susu: 25% Orange), Kefir Mango 50 (50% kefir: 50% Mango), Kefir Susu Mango 30 (30% kefir: 35% Susu: 35% Mango)

Consumer acceptability was evaluated based on taste, aroma, color, and texture. The most preferred formulations included mango kefir (50%) and dragon kefir (50%), while banana kefir (30%) was the least favored (Wijaningsih et al., 2024). The hedonic test results showed significant differences ($p<0.05$) in aroma, viscosity, taste, and color preferences, highlighting the importance of fruit selection and fermentation balance in product development.

4. Conclusion and Suggestion

This study confirms that fruit addition significantly affects the nutritional composition, sugar content, acidity, fiber levels, probiotic count, and consumer acceptability of kefir. Mango kefir (50%) and dragon kefir (50%) were the most preferred, while banana kefir (30%) was the least favored. Kefir remains a nutrient-dense, probiotic-rich beverage, with optimized formulations enhancing both health benefits and consumer appeal, making it a functional food for modern diets.

Future studies are encouraged to explore the long-term health benefits of regular consumption of these kefir variants, particularly in relation to gut health and metabolic conditions. It is also recommended to analyze the shelf life and microbial stability of the products under different storage conditions. To enhance consumer appeal, further research may consider optimizing flavor profiles and exploring the use of alternative fruit combinations.

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