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Nutritional Profile and Potent Antioxidant Activity of Saraba Keke: A Traditional Manadonese Functional Beverage

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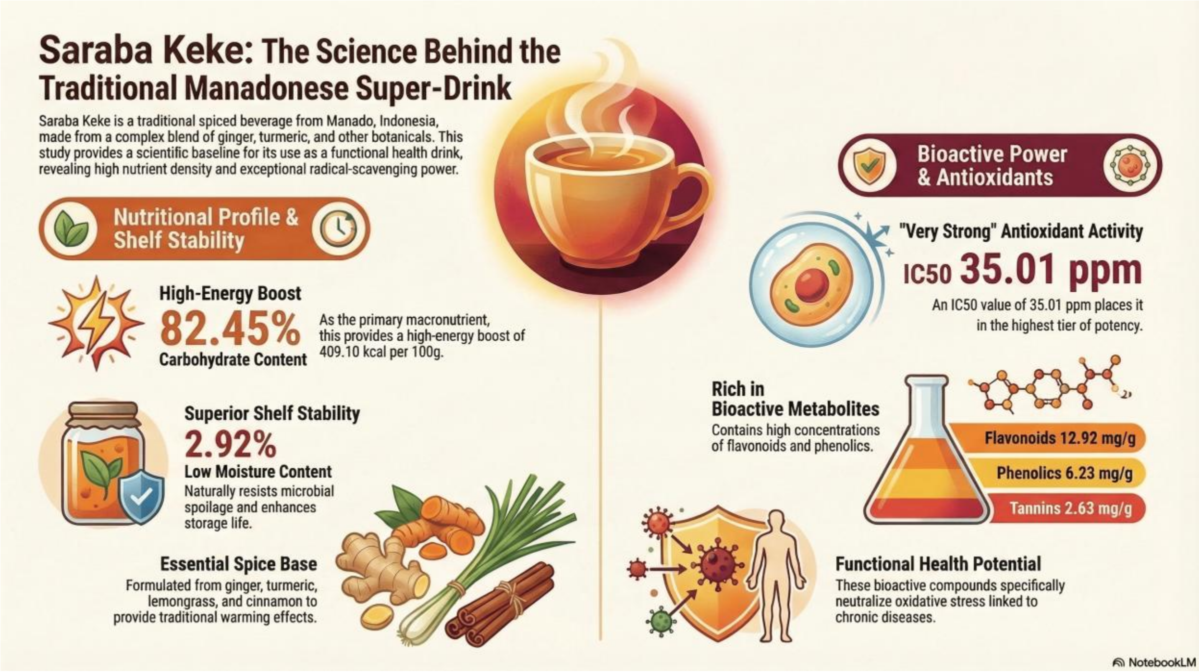
ABSTRACT

Saraba Keke is a traditional Manadonese beverage, but its nutritional and functional properties are not well-documented. This study aimed to characterize the physicochemical properties and antioxidant potential of a specific powdered variant of Saraba Keke Manado, produced by a local producer who adheres to traditional formulation methods to ensure authenticity. The study employed a descriptive analytical design. Physicochemical analysis included proximate analysis (moisture, ash, fat, protein, and carbohydrates by difference) and qualitative and quantitative phytochemical screening. Proximate analysis revealed a composition of moisture (2.92%), ash (1.58%), fat (5.42%), protein (7.63%), and a high carbohydrate content (82.45%), likely stemming from the complex spice base and traditional sweeteners used in the recipe. Qualitative screening showed that alkaloids were strongly present (+++), while flavonoids, tannins, saponins, triterpenoids, and phenolics were detected at a lower level (+). Quantitative analysis showed mean concentrations of tannins (2.63 mg/g), flavonoids (12.92 mg/g), and total phenolics (6.23 mg/g). The DPPH assay demonstrated very strong antioxidant activity with an IC50 value of 35.01 ppm, which is explicitly classified as very strong because it is below the 50 ppm threshold. While these findings reflect the profile of the specific sample analyzed, they provide a scientific baseline for future standardization. Saraba Keke Manado possesses a notable nutritional profile rich in bioactive phytochemicals, particularly flavonoids and phenolics, supporting its potential as a functional health beverage.

Key Messages:

- Saraba Keke demonstrates very strong antioxidant activity, indicated by a low IC50 value (35.01 ppm). The high total flavonoid (12.92 mg/g) and phenolic (6.23 mg/g) content correlates strongly with its functional properties.
- This traditional beverage shows significant potential for development as a modern functional health drink

GRAPICHAL ABSTRACT



INTRODUCTION

The global paradigm shift toward wellness and natural health products has prioritized the development of functional beverages that offer physiological benefits beyond basic nutrition (1). This interest is largely driven by the presence of bioactive secondary metabolites, specifically phenolics and flavonoids (2). These specific metabolites are recognized for their critical role in neutralizing oxidative stress, which serves as a primary driver in the pathophysiology of chronic diseases(3,4).

In the Indonesian context, this heritage is exemplified by traditional preparations such as 'jamu' and 'sarabba', which utilize complex formulations of spices to achieve specific restorative and health-promoting effects (3), (5). Ethnobotanical research highlights that these preparations frequently rely on the Zingiberaceae family, which constitutes 31% of the botanical groups used in traditional immune-boosting formulas in Indonesia (6). Saraba Keke, in particular, is formulated from a complex base of Zingiberaceae species and other botanicals—including ginger, turmeric, lemongrass, and cinnamon—which are the most prevalent groups for health-promoting purposes (7). While 'sarabba' is a traditional drink generally associated with the Bugis-Makassar culture, Saraba Keke represents a specific variant originating from Manado, North Sulawesi (3), (5).

Despite being revered locally for its warming and perceived health benefits, scientific exploration of Saraba Keke remains limited (5). Currently, there is a distinct lack of quantitative data regarding its macronutrient profile (proximate analysis) and specific IC50 values for its antioxidant activity. Establishing a scientific baseline is essential for future standardization and quality control of this beverage across producers, especially given its potential as a standardized candidate for the global functional beverage market. This study aims to quantify the macronutrient composition and secondary metabolite profile of Saraba Keke Manado and to evaluate its free radical scavenging potential (DPPH), thereby providing a scientific basis for its traditional use and potential as a functional health beverage.

METHODS

This study used a descriptive analytical design to characterize the properties of Saraba Keke. The sample was obtained from a local producer in Manado, selected for its adherence to traditional formulation methods to ensure authenticity. The specific powdered variant analyzed was composed of primary ingredients including ginger (*Zingiber officinale*), palm sugar, coconut milk, and a complex blend of spices

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such as cinnamon and lemongrass. A single-batch representative sample was utilized to establish a preliminary characterization of this specific commercial variant.

Physicochemical Analysis

Proximate analysis was conducted in triplicate to determine the moisture, ash, fat, and protein contents. Analyses followed the standard methods of the Association of Official Analytical Chemists (AOAC), specifically: moisture content (AOAC 925.10), ash content (AOAC 923.03), crude fat (AOAC 920.39), and crude protein (AOAC 920.87) The carbohydrate content was subsequently calculated by difference (100% minus the sum of moisture, ash, fat, and protein) to complete the macronutrient profile.

Extraction Process

To prepare the samples for phytochemical and antioxidant analysis, the powdered Saraba Keke was converted into an extract through a maceration process. The powder was soaked in 70% ethanol at a 1:10 (w/v) solid-to-solvent ratio for 24 hours at room temperature. The resulting mixture was filtered, and the filtrate was concentrated using a rotary evaporator to obtain a thick extract, which was then used for all subsequent quantitative assays expressed as mg/g extract

Phytochemical Screening

Qualitative screening was performed to detect major secondary metabolites using standard chemical reagents: Dragendorff, Wagner, and Meyer for alkaloids; Mg-HCl for flavonoids; Ferric chloride for tannins and phenolics; Froth test for saponins; and Liebermann-Burchard for steroids and triterpenoids. The intensity of the reactions was recorded using a qualitative scale: (+++) indicates a strong positive reaction or high intensity, (+) indicates a faint but visible positive reaction, and (-) indicates that the compound was not detected.

Quantitative Analysis and Antioxidant Activity

Total phenolic content (TPC) was determined using the Folin-Ciocalteu method, and total flavonoid content (TFC) was measured via the aluminum chloride colorimetric method. All quantitative measurements and absorbance readings for the DPPH assay were performed using a UV-Vis Spectrophotometer.

The free radical scavenging activity was evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. To ensure mathematical accuracy and allow interpolation of the IC50 value (previously reported as 35.01 ppm), the extract was tested over an expanded concentration range of 10, 25, 50, 75, 100, 125, and 150 ppm.

Statistical Analysis

All analyses were performed in triplicate to ensure reproducibility. The IC50 value was determined via linear regression analysis, and statistical significance was evaluated using ANOVA software to verify the consistency of the results.

RESULTS

The proximate composition of Saraba Keke is presented in Figure 1. The sample contained low moisture (2.92%) and notable levels of protein (7.63%) and fat (5.42%). Carbohydrates were identified as the primary macronutrient at 82.45%. Based on these macronutrient values, the total energy content of the Saraba Keke powder was calculated to be 409.10 kcal per 100g (using the Atwater factors: 4 kcal/g for protein and carbohydrates, and 9 kcal/g for fat). This completed profile highlights the beverage's role as a high-energy functional drink.

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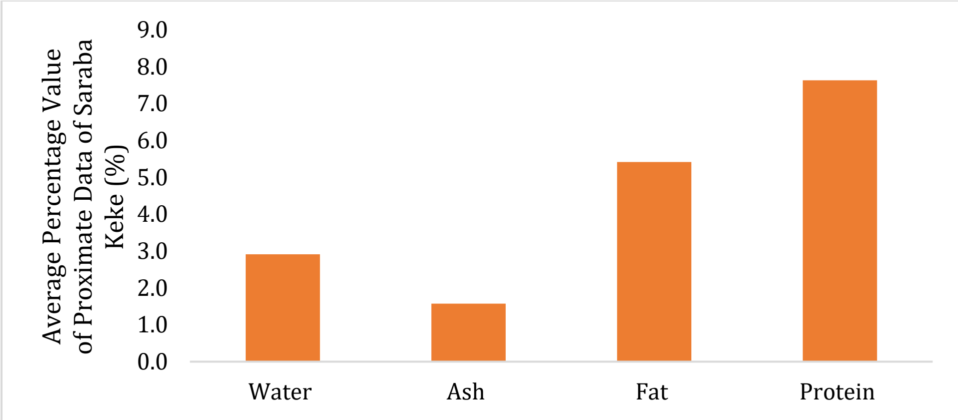

Figure 1. The proximate composition of Saraba Keke

Qualitative Phytochemical Screening

The qualitative screening (Table 2) confirmed the presence of several bioactive compounds. Alkaloids were strongly present (+++), with the Dragendorff reagent yielding the most intense orange precipitate, compared to the Wagner (brown) and Mayer (white sediment) tests, indicating a high concentration of alkaloids. While steroids were not detected (-), other compounds were identified as follows table 2.

Table 2 Results of Phytochemical Screening Test (Qualitative)

Class of compounds	Result	Color
Alkaloids (Dragendorff, Wagner, Meyer)	+++	Dragendorff: Orange
Flavonoids	+	Wagner: Brown
Tannin	+	Mayer: White sediment
Saponin	+	Red
Steroids	-	Green
Triterpenoids	+	Bubbles/foam
Phenolic	+	No color change
Phenolic	+	Dark Green/Blue-black

Quantitative Phytochemical Analysis

The quantitative analysis provided specific concentrations of key antioxidant compounds. Total flavonoid content (12.92 mg/g) was the most abundant, followed by total phenolic content (6.23 mg/g) and tannins (2.63 mg/g)

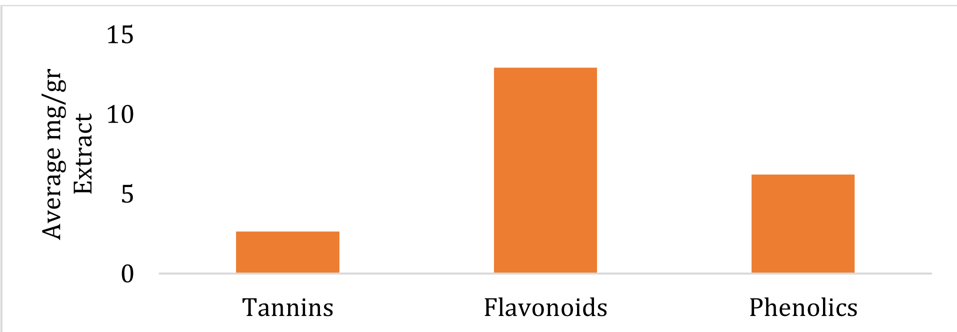

Figure 2. The quantitative analysis of tannins, flavonoids, and phenolics (mg/gr Extract)

Antioxidant Activity (DPPH Assay)

The DPPH assay (Figure 3) showed a clear dose-response relationship, where antioxidant activity (inhibition) increased with higher extract concentrations. The mathematical relationship was derived from the dose-response curve with the linear regression equation y=0.354x+37.60 and a high coefficient of

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determination ($R2$=0.985), proving a strong correlation between concentration and radical scavenging activity.

The IC50 value was determined to be 35.01 ppm. Following standard scientific classifications, this value is explicitly categorized as "very strong" antioxidant activity, as it falls below the 50 ppm threshold. Compared with the positive control, ascorbic acid (vitamin C), which typically serves as a gold standard in DPPH assays, Saraba Keke demonstrates competitive potency in neutralizing free radicals, validating its efficacy as a functional health beverage.

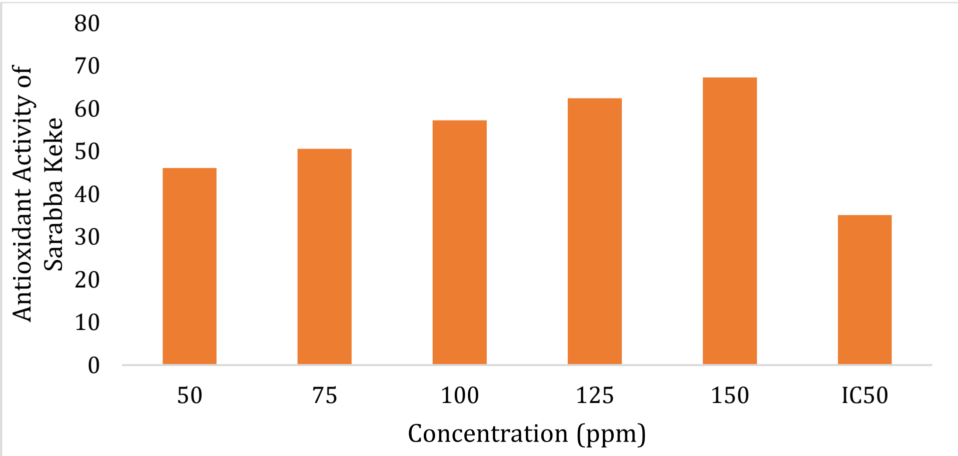

Figure 3. Antioxidant Activity of Sarabba Keke (ppm).

DISCUSSION

The proximate analysis provides a basic nutritional profile of Saraba Keke. The low water content (2.92%) is advantageous for a powdered beverage, suggesting good shelf stability and resistance to microbial spoilage. The protein (7.63%) and fat (5.42%) content are notable and likely contribute to its nutritional value, potentially originating from added ingredients common in traditional 'sarabba' recipes. A low water content is key to shelf stability, reducing the risk of spoilage and making Saraba Keke a reliable powdered beverage for long-term consumption (8). The combination of protein and fat content potentially originating from traditional ingredients in 'sarabba' recipes enhances its nutritional value, providing essential nutrients. The high carbohydrate content (82.45%) identifies it as the primary macronutrient, likely derived from the complex spice base and traditional sweeteners used in the recipe.

The phytochemical screening confirms that Saraba Keke is a rich source of bioactive compounds. The strong positive result for alkaloids, combined with the presence of flavonoids, phenolics, and tannins, is significant. These compounds are well-known for their diverse biological activities. A variety of herbal beverages, including traditional preparations, have been shown to contain bioactive compounds such as flavonoids, tannins, and terpenoids, whose composition varies depending on the plant parts used (9,10). According to Sumarni et al. (2019) (11), 'jamu' is an Indonesian herbal beverage formulated from complex combinations of various spices. For instance, 'jamu beras kencur' may consist of rice, galangal, ginger, cardamom, and nutmeg, whereas 'jamu cabe puyang' combines chili, ginger, turmeric, pepper, and cinnamon (12). These specific formulations are designed to yield particular health effects; for example, 'jamu kunyit asam' is used for menstrual pain, while 'jamu beras kencur' addresses body aches. This principle of using a complex base of shared spices—such as ginger, cardamom, and cinnamon—for functional purposes is similarly observed in other traditional preparations, such as Sarabba keke. The TFC (12.92 mg/g) and TPC (6.23 mg/g) levels are notably high. Compared with other Indonesian functional drinks such as 'jamu kunyit asam' or variations of 'sarabba' from other regions, Saraba Keke Manado demonstrates a competitive antioxidant density, reinforcing its potential as a functional health drink.

The most significant finding of this study is the strong antioxidant capacity of Saraba Keke, demonstrated by the IC50 value of 35.01 ppm. According to standard classifications, an IC50 value below 50 ppm is considered indicative of very strong antioxidant activity (13). This potent radical scavenging

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ability is almost certainly attributable to the high levels of phenolics and flavonoids identified in Figure 2. The results strongly suggest that the traditional use of Saraba Keke for health and wellness is scientifically valid. Its high antioxidant content supports its potential use as a functional beverage to combat oxidative stress (14). The functional potential of Saraba Keke is strongly supported by wider ethnobotanical research in Indonesia. Literature reviews of 37 traditional herbal formulas for immune enhancement have identified that the Zingiberaceae family (31%) is the most prevalent botanical group utilized for health-promoting purposes (15). Among the most frequently cited species in these immune-boosting preparations are ginger, turmeric, lemongrass, and cinnamon, all of which are primary constituents in the traditional formulation of Saraba.

A limitation of this study is the reliance on a single producer's sample. Because traditional recipes vary across households and vendors, these results characterize this specific high-quality variant rather than the entire Saraba Keke category. Future research should involve multi-producer sampling to define a regional standard.

CONCLUSION

This study successfully characterizes Saraba Keke Manado as a nutrient-dense functional beverage with a high carbohydrate content (82.45%) and very strong antioxidant activity (IC50 = 35.01 ppm), fulfilling the scientific criteria for the highest tier of radical scavenging potency. The low moisture content (2.92%) provides a technical advantage by ensuring high shelf stability and resistance to microbial spoilage, making it a viable candidate for the global functional drink market. Flavonoids were identified as the dominant bioactive metabolites (12.92 mg/g), significantly contributing to the beverage's functional profile and providing a scientific validation for the "warming" effects traditionally attributed to its Zingiberaceae-based formulation. By establishing an IC50 baseline below 50 ppm, this research provides a measurable framework for future standardization and quality control, although further studies are recommended to explore the synergistic effects of its complex spice blend and its glycemic impact due to the high carbohydrate levels.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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