The effect of maceration on the organoleptic properties of ginger-based functional beverages

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ABSTRACT

Functional beverages represent a category of beverages that provide both sensory satisfaction and health benefits. In Indonesia, functional beverages such as jamu or herbal drinks are typically formulated from one or more combinations of spices or herbs. One frequently utilized herb is white ginger. In this study, the herbal beverage was formulated using a combination of white ginger, lemongrass, cinnamon, cloves, and pandan leaves. The objective of this study was to determine the effect of maceration on the sensory properties of ginger-based functional beverages. The maceration process was subdivided into three treatments: soaking for 0 (T1), 6 (T2), and 12 (T3) hours. The organoleptic test results were subjected to statistical analysis using Analysis of Variance at a confidence level of 5%. Preliminary organoleptic testing results indicate that the maceration process exerts a significant influence on the sensory characteristics of the functional beverage under investigation. Specifically, an increase in maceration time was associated with elevated color and turbidity scores, while concurrently resulting in a reduction in taste scores. In conclusion, based on the preferences of the panel, treatment T3 was most preferred for color and turbidity, while T1 was most preferred for its taste.

Keywords: bioactive compounds; functional food; white ginger

INTRODUCTION

Functional beverages are defined as a type of beverage that has been demonstrated to have positive effects on human health (Putri et al., 2021). This is due to the fact that functional beverages contain a variety of bioactive compounds, including polyphenols, flavonoids, tanins, alkaloids, terpenoids, and saponins. The global consumption of functional beverages encompasses a wide range of categories, including sports drinks, energy drinks, health and beauty drinks, and fortified beverages. The production of functional beverages entails the utilization of diverse components derived from various sources, including plants, animals, and microorganisms (Gupta et al., 2023; Maleš et al., 2022).

In Indonesia, the practice of functional beverages has been transmitted from generation to generation in the form of traditional herbal drinks (including jamu), which vary according to region. The production of herbal beverages in Indonesia involves the use of one or more combinations of spices or herbs. These include ginger (*Zingiber officinale Roscoe*), turmeric (*Curcuma longa L.*), cardamom (*Elettaria cardamomum Maton*), mahkota dewa (*Phaleria macrocarpa*) (Batubara & Prastya, 2020), cinnamon (*Cinnamomum verum Blume*), secang (*Myristica fragans Houtt.*), andaliman (*Zanthoxylum acanthopodium*) (Helmalia et al., 2019), lemongrass (*Cymbopogon citratus*

(Blanco) Steud.), cloves (*Syzygium aromaticum (L.) Steud.*), and nutmeg (*Myristica fragans Houtt.*) (Masnar & Pinandoyo, 2020). A comprehensive review of the extant research reveals that spices and herbs in general have antioxidant, antibacterial, and antiviral properties. These properties have been demonstrated to enhance bodily health and immune system function (Masnar & Pinandoyo, 2020). Consequently, Indonesia possesses the potential to emerge as a significant exporter of functional beverages derived from spice and herbal ingredients.

In this study, a herbal beverage was formulated using a combination of white ginger, lemongrass, cinnamon, cloves, and pandan leaves. To enhance the extraction of bioactive compounds, a maceration process was incorporated into the production process of this functional beverage. The objective of this study was to determine the effect of maceration on the sensory properties (color, aroma, taste, and viscosity) of ginger-based functional beverages.

METHODOLOGY

1. Preparation of raw materials

The raw materials for herbal beverages (i.e., white ginger, lemongrass, cinnamon, cloves, pandan leaves, and brown sugar) are procured at Bertais Market in Mataram. The raw materials, with the exceptipn of brown sugar, are meticulously sorted to ensure the quality of the herbs utilized and subsequently washed. Subsequent to this step, the ingredients are meticulously measured in accordance with the stipulated recipe.

2. Production of herbal beverages

One kilogram of white ginger is roasted until it releases its characteristic aroma. Subsequent to this process, the skin of the roasted ginger is peeled off and then crushed. Subsequently, the crushed ginger is introduced into a large pot, accompanied by 1 kilogram of sifted brown sugar, 100 grams of lemongrass stalks, 10 grams of cloves, 20 grams of cinnamon, 40 grams of pandan leaves, and 3.2 liters of purified water. The herbal mixture is subjected to boiling until it comes to a boil. Subsequently, the maceration process is executed for a duration of several hours, contingent upon the designated treatment (0, 6, and 12 hours, respectively). Following the maceration process, the herbal beverage undergoes a second round of cooking, albeit not until it attains boiling point. Subsequent to a brief period of cooling, the beverage is transferred to PE bottles and made available for organoleptic evaluation.

3. Organoleptic test

The organoleptic test was conducted with the participation of 20 semi-trained panelists. The organoleptic parameters evaluated encompassed color, aroma, taste, and viscosity. The sensory property assessment was conducted in accordance with the methodology outlined by Setyaningsih et al. (2010). A hedonic scale ranging from 1 (strong dislike) to 5 (strong like)

was employed to evaluate aroma and taste, while a scoring method was utilized to assess color and viscosity. The color was evaluated on a scale ranging from 1 (yellow) to 5 (very brown), while the viscosity was scored on a scale from 1 (thin) to 5 (very thick).

RESULTS AND DISCUSSION

Maceration is one of the methods employed to extract bioactive compounds found in plant samples (Tambun et al., 2021). Consequently, the objective of this particular study was to employ the maceration process to enhance the extraction of chemical compounds present in the herbs utilized in the beverage. In order to observe the effect of maceration on the organoleptic properties of herbal beverages, a series of maceration trials were conducted. These trials involved maceration durations of 0 (T1), 6 (T2), and 12 hours (T3). The organoleptic properties that were observed included color, aroma, taste, and viscosity. The results of the organoleptic test will be discussed further in the following sub-chapters.

1. Color

Colour is the first sensory element that can be observed by panelists (Negara et al., 2016). The color of food products is influenced by the raw materials used and the processing methods employed (S. N. Y. Putri et al., 2021). The effect of maceration on the color of herbal beverages is demonstrated in Figure 1.
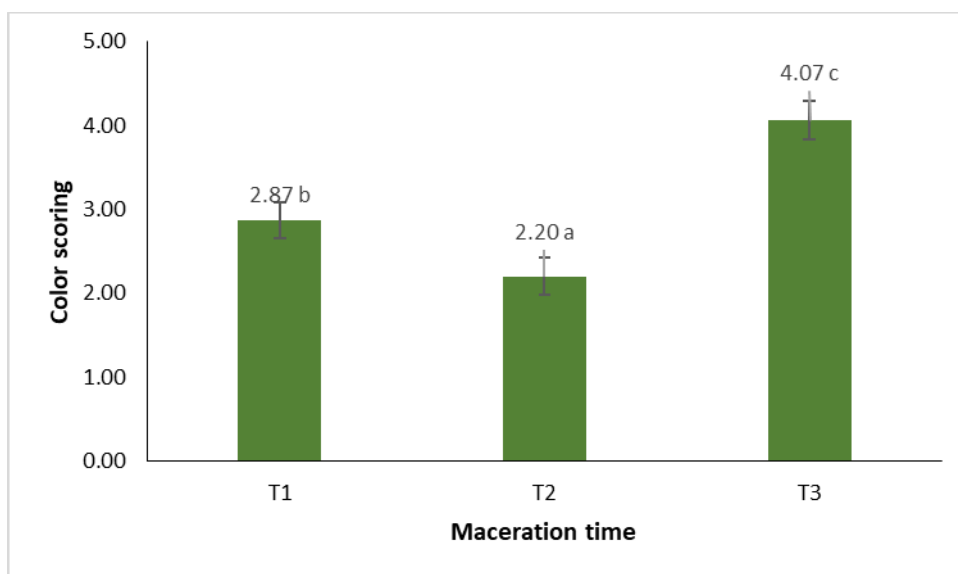

Figure 1. Effect of maceration time on color score of herbal drinks

Preliminary analysis of variance indicates a statistically significant relationship between the duration of maceration and the preference of the panelists for the color of the herbal beverage produced. The duration of the maceration process is directly proportional to the transformation of the beverage's color, which undergoes a transition from mild brown to dark (see Figure 2). This is due to longer contact between the solvent (water) and the solute (bioactive compounds), resulting in an increased extraction of metabolites (Ardyanti et al., 2020; Meutia et al., 2015).

Figure 2. Functional beverages color comparison of 3 treatments

2. Aroma

Aroma, defined as a smell caused by chemical stimuli detected by the olfactory nerves located in the nasal cavity, is a subject of considerable interest in the study of sensory perception (Negara et al., 2016). The aroma of herbal beverages is contingent upon the presence of particular volatile compounds inherent in the raw materials employed in their production (Sari et al., 2023). The herbal beverage in this study is composed of white ginger, lemongrass, cinnamon, cloves, and pandan leaves. The presence of varying volatile compounds, resulting from the combination of these ingredients, contributes to the creation of a unique aroma. The effect of maceration on the aroma of herbal beverages is demonstrated in Figure 3.
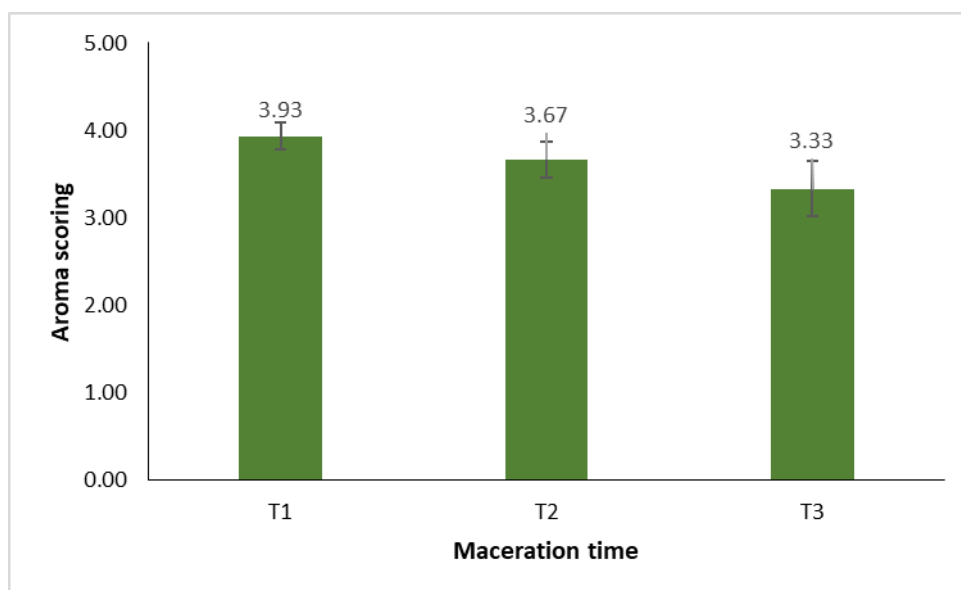

Figure 3. Effect of maceration time on aroma score of herbal drinks

The results of the study demonstrated that the hedonic test of herbal beverage aromas yielded panelist preference scores ranging

from 3.3 (somewhat liked) to 3.93 (liked). A negative correlation was observed between the panelists' preference for the aroma and the aroma's maseration time. However, these results did not attain statistical significance.

3. Taste

Taste is defined as a sensory perception detected by the tongue. This parameter is of the utmost importance in determining the acceptance of a product by panelists. The following factors have been identified as potentially affecting taste: temperature, concentration, and interaction with other taste components (S. N. Y. Putri et al., 2021). The effect of maceration on the taste of herbal beverages is demonstrated in Figure 4.
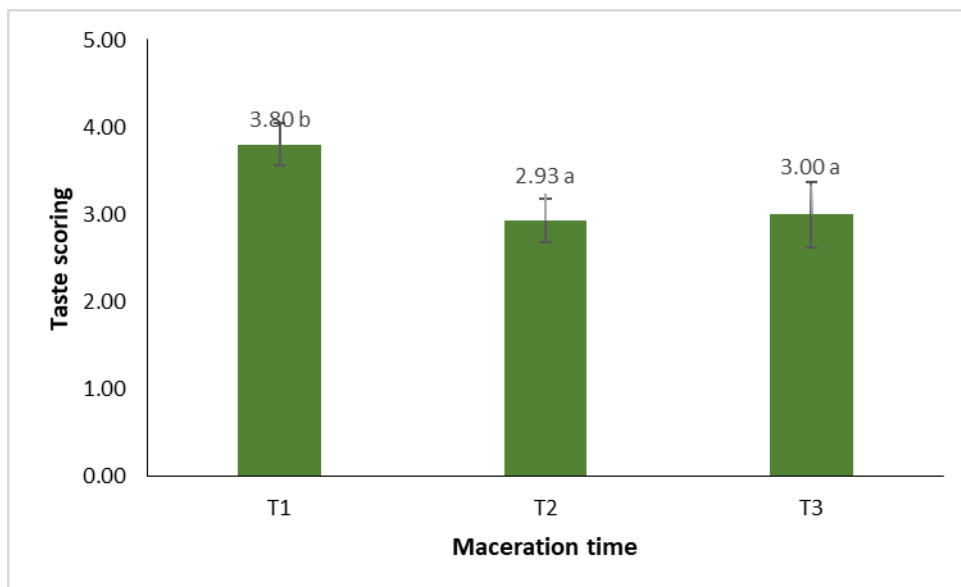

Figure 4. Effect of maceration time on taste score of herbal drinks

The findings of the variance analysis of organoleptic properties indicated that the duration of maceration exerted a substantial influence on the panelists' preferences regarding the taste of the herbal beverages produced. The duration of maceration was found to have a direct correlation with the panelists' preferences for the herbal beverages. The results showed that the panelists preferred the taste of herbal drinks in T1 the most, giving it a score of 3.80 for the "like" criterion. They preferred treatment P2 the least, giving it a score of 2.93 for the "somewhat like" criterion. The waning popularity of herbal beverages can be attributed to the increasingly robust spicy taste that results from the maceration process.

4. Viscosity

The viscosity of a beverage is influenced by the interaction between the dispersion phase and the dispersed solid ingredients (Faiqoh et al., 2021). The effect of

maceration on the viscosity of herbal beverages is illustrated in Figure 5.
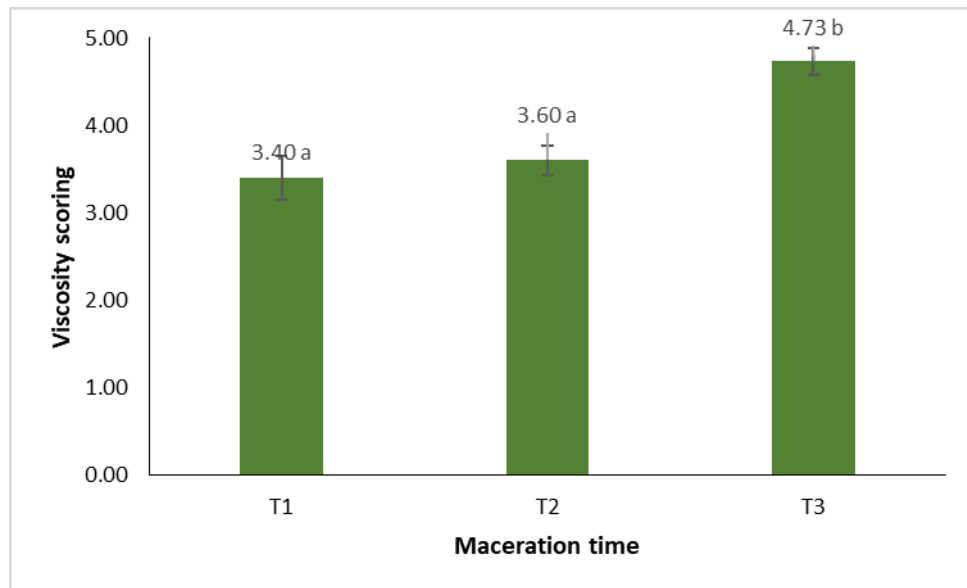

Figure 5. Effect of maceration time on viscosity score of herbal drinks

The findings of the variance analysis of organoleptic properties indicated that the duration of maceration exerted a substantial influence on the panelists' preferences regarding the viscosity of the herbal beverages produced.

It is evident that an extended maceration period results in a higher viscosity of the final product. In summary, the maseration process enhances the stability of the formed suspension (Wijaya & Lina, 2021).

CONCLUSION

The maceration process has been demonstrated to exert a significant influence on the sensory characteristics of the functional beverage under study, except for the aroma. Furthermore, an increase in maceration time was associated with elevated color and turbidity scores, while concurrently resulting in a reduction in aroma and taste scores. To conclude, treatment T3 (12 hours maceration) was most preferred for its color and viscosity, whilst treatment T1 (no maceration) was the most preferred by the panelists for its taste.

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