Chapter 1

Introduction

1.1 Background

Breadfruit (*Artocarpus altilis*) is a tropical fruit which can be found in most tropical countries like Indonesia. Breadfruit is often consumed due to its rich in carbohydrates, low in fat, cholesterol, gluten free and many other essential micronutrients (Mehta et al., 2023). However, the breadfruit tree also offers another valuable yet underutilized resource which is its leaves. Breadfruit leaves have a unique structure and shape as they have large, oval, glossy green leaves, three- to nine-lobed toward the apex. It is known that breadfruit leaves were able to be utilized into medicines as they contain high antioxidants, flavonoids, phenolics, tannins, alkaloids, and saponins (Yumni et al., 2024). In pharmaceutical industries, breadfruit leaves were utilized as a treatment for several diseases such as liver disease, hepatitis, enlarged spleen, heart, kidney, high blood pressure and diabetes, using breadfruit leaves are rich in compounds of flavonoids to prevent the increase in blood cholesterol levels (Mu'nisa et al., 2018).

Recent studies have shown that breadfruit leaves were able to be utilized as an alternative for tea as it is caffeine free, which makes it viable for consumers that want to cut down their caffeine consumption. It is also shown that breadfruit leaves tea exhibits high antioxidant activity which is similar to a green tea (Leng et al., 2018). The process of making breadfruit leaves tea is similar to normal tea leaves making, the breadfruit leaves would undergo a drying process which would preserve and reduce the moisture content , inhibit microbial growth, extend shelf life and also contribute in forming the tea flavors (Chobot et al., 2024). During this drying process degradation reaction, Maillard reaction, redox reaction, isomerization reaction were happening in order for the formation of the tea flavors (Wang et al., 2024).

A study by Azli et al. (2018) conducted an analysis on sensory, phytochemicals, antioxidant activity, nutritional content, and physico chemicals on different infusion temperatures (45°C, 80 °C and 100°C) of breadfruit leaves. The acceptability sensory results exhibit a score of 5.6 which makes it an average score, due to the presence of more tannins found in breadfruit leaves compared to normal tea leaves which contribute to the bitter and astringent taste (Soares et al., 2020). By incorporating a carbonation process, this produces carbonic acid that creates an acidic environment and enhances the sourness and saltiness flavor which can mask the bitter and astringent flavor (Vlădescu et al., 2021). Therefore the researcher would like to incorporate carbonation on the breadfruit leaves tea to see whether it could improve the sensorial qualities of the product, while also assessing the other parameters (antioxidant, pH, Brix, and color) before and after the carbonation. Carbonation is a process which involves dissolving carbon dioxide (CO_2) into the beverage which could significantly alter the texture, flavor, and overall sensory experience of the tea (Barker et al., 2021). A study by Newbold & Koppel (2018) found out that carbonation at an appropriate level can improve the sensorial characteristics of dairy beverages.

The market of carbonated drinks has been gradually increasing little over the past. Carbonated beverages encompassess a large variety of products such as soft drinks, energy drinks, sparkling waters, and flavored sodas. This market growth is driven due to consumer's lifestyles, demand on convenient and refreshing drinks, and ongoing product innovation. However, consumers are starting to be concerned about the health implications caused from consuming carbonated beverages like diabetes, weight gain, and oral effects (Tahmassebi & BaniHani, 2019). Therefore, by using carbonation on tea, which has health benefits, would be perceived as a healthier alternative for consumers that seek both health benefits from the tea as well as the refreshment like a soda.

This study seeks to explore how carbonation impacts key physicochemical properties such as pH, brix, color, and antioxidant activity. Carbonation causes decrease of pH of pH due to the formation of

carbonic acid during the carbon dioxide dissolves in the water (Santoso et al., 2022). Although carbonation may not alter the sugar content of the beverage, the presence of carbonic acid may cause changes in brix result. As for the color aspect, it is expected that the color would tend to be darker as due to the presence of carbon dioxide bubbles also contributes to light scattering, making beverages appear slightly hazy (Kupikowska-Stobba et al., 2024). A study by Khanniri et al. (2018) evaluated the antioxidant activity of a carbonated probiotic grape beverage and it shows that carbonation increases the antioxidant activity but not significantly. Additionally, the sensory attributes will be evaluated including taste, aroma, mouthfeel, fizziness, and overall acceptability. It is to determine how carbonation enhances or modifies the consumer taste. Understanding these impacts will help researchers create a new, functional carbonated breadfruit leaf tea that blends the refreshing appeal of carbonated drinks with the health advantages of breadfruit leaves.

1.2 Objective

There are two objectives from this research:

1. To evaluate the effect of different drying/firing temperature on antioxidant activity, moisture content and color of breadfruit leaves
2. To investigate the effect of carbonation towards the physicochemical (pH, brix, antioxidant, color) and sensorial properties (hedonic & Just-About-Right) of breadfruit leaves tea.

1.3 Hypothesis

- Hypothesis 1

  H_0 = There is no significant differences on the effect of different drying temperature on breadfruit leaves towards the antioxidant activity, moisture content and color

  H_1 = There is significant differences on the effect of different drying temperature of breadfruit leaves towards the antioxidant activity, moisture content and color

- Hypothesis 2

H_0 =There is no significant differences in the pH, brix, antioxidant, hedonic, JAR and color of the carbonated and non carbonated breadfruit leaves tea

H_1 = There is significant differences in the pH, brix, antioxidant, hedonic, JAR and color of the carbonated and non carbonated breadfruit leaves tea