Chapter 1

Introduction

1.1 Background

Bread is considered a staple food, with a global average consumption of 59 to 70 kg per capita (Benayad et al., 2021). In Indonesia, bread is the second most consumed carbohydrate food source after rice regardless of income (Rizka et al., 2018). However, despite bread's popularity, there is an emerging concern regarding one of its components, which is gluten found in wheat flour (Fardet, 2015). This is due to the increasing prevalence of celiac disease, which affects 1% of the global population (Kurppa et al., 2024; Popp & Mäki, 2019). Other than that, gluten avoidance is also driven by non-celiac gluten sensitivity (Losurdo et al., 2018; Tovoli et al., 2015). Hence, gluten-free products are developed to accommodate people suffering from gluten-related complications (Kaur et al., 2022).

In Indonesia, two of the most commonly found gluten-free alternatives are rice flour and modified cassava flour (MOCAF) (Susman et al., 2020). Rice flour is considered a popular gluten-free flour choice for breadmaking due to its low cost, bland taste, and hypoallergenic properties (Masure et al., 2016; Roman et al., 2016). As for MOCAF, it is expected to become a wheat flour substitute in the country due to characteristics similarity, such as white color and soft texture (Anindita et al., 2019; Martiyanti et al., 2015). Despite that, gluten-free breads, including those made with the aforementioned flours, are difficult to develop due to the absence of gluten, which removes the elasticity, fluffiness, and gas retention ability during fermentation (Capriles et al., 2021; Conte et al., 2018; Zaidiyah et al., 2022). Moreover, most gluten-free flours, including MOCAF and rice flour, lack protein content (Naqash et al., 2017). As a result, gluten-free bread has less preferred characteristics, such as dense, hard, and crumbly texture, along with lack of structural integrity (Culetu et al., 2021; Porcel et al., 2017).

In order to further improve the characteristics of gluten-free bread, okara flour could be utilized (Hariono et al., 2024). Okara is a solid by-product of insoluble fiber obtained from soy milk filtration with high potential to be repurposed in the food industry (Gao et al., 2016). This is due to its nutritional content in protein and fiber, which contributes to technological benefits such as promoting structural integrity and matrix cohesiveness in the resulting products (García-Alonso et al., 2022; Porcel et al., 2017).

A study by Lian et al. (2019) found that okara flour improves water absorption capacity, viscosity, mouthfeel, and crumb color in rice flour and cornstarch-based gluten-free bread. However, they found that sensory likability reduced with the addition of okara flour, posing a challenge in formulating gluten-free bread that balances functional benefits with consumer acceptability. On the other hand, Pešić et al. (2023) found that the highest okara substitution (30%) in gluten-free bread containing buckwheat, rice, and millet flour resulted in the highest sensory scores (taste, odor, and chewiness). However, the okara flour production method that they used was inefficient for upscale production. Furthermore, there are limited studies utilizing MOCAF in gluten-free breads, and no study has investigated the effect of okara incorporation towards gluten-free bread made with MOCAF and rice flour, which is important for developing locally sourced, affordable gluten-free products in regions where MOCAF is widely available such as in Indonesia. Hence, this study will develop a gluten-free bread with MOCAF and rice flour, with rapid oven drying as the okara flour production method.

In terms of the analysis, there are limited studies covering the sensory evaluation of gluten-free breads, especially made with MOCAF and/or okara flour. Therefore, in addition to physical properties and sensory likability, check-all-that-apply (CATA) will also be conducted to obtain objective sensory attributes profile of the bread samples.

1.2 Objective

1. To evaluate the effect of different okara flour substitution levels towards the physical properties of gluten-free bread made with MOCAF and rice flour.

2. To determine the effect of different okara flour substitution levels towards the sensory attributes of gluten-free bread made with MOCAF and rice flour.

3. To determine the effect of different okara flour substitution levels towards the consumer acceptability of gluten-free bread made with MOCAF and rice flour.

1.3 Hypothesis

H0: Different okara flour substitution levels in gluten-free bread will not cause significant difference in the physical properties (i.e., baking loss, volume, color, texture, and moisture content), sensory attributes (i.e., appearance, aroma, texture, taste, and mouthfeel), and consumer acceptability.

H1: Different okara flour substitution levels in gluten-free bread will cause significant difference in the physical properties (i.e., baking loss, volume, color, texture, and moisture content), sensory attributes (i.e., appearance, aroma, texture, taste, and mouthfeel), and consumer acceptability.