CHAPTER II
LITERATURE REVIEW

2.1 Ingredient Review

2.1.1 Breadfruit

Breadfruit (*Artocarpus altilis*) is often overlooked despite being abundant in nutrients and complex carbohydrates, with low levels of fat and cholesterol. It contains a diverse array of amino acids, particularly rich in leucine, isoleucine, phenylalanine, and valine, making it a valuable source of essential amino acids, especially in regions fighting malnutrition. Originating from the Western Pacific, particularly in areas like New Guinea and nearby islands, breadfruit is an underutilized crop with high productivity, thriving in tropical and subtropical climates found in regions like South America, the Caribbean, and Oceania (Mehta, et al., 2023).

Breadfruit serves as a significant energy source due to its starch and sugar content, readily providing fuel for the body. Depending on its ripeness, it can be rich in carotenoids, crucial for producing vitamin A, essential for immune function and vision maintenance. Additionally, breadfruit contains both soluble and insoluble dietary fiber, promoting gastrointestinal health. It also boasts high levels of potassium, vital for nerve, muscle function, and blood pressure regulation. Fermented breadfruit may contain probiotics, aiding in the prevention and management of various communicable and non-communicable diseases. Overall, breadfruit products like flour and starch offer versatility for incorporation into various food items, providing additional nutritional benefits (Bawa & Webb, 2016).

Figure 2.1 Breadfruit

2.1.2 Tapioca Starch

Tapioca starch has a fine powdery texture that comes from the starchy root of the cassava plant (*Manihot esculenta*). It is a gluten-free and grain-free flour commonly used as a thickening agent in cooking and baking. Tapioca starch is extracted from the cassava root through a process of washing, grating, and then either pressing or fermenting the pulp to extract the starch. Once extracted, the starch is dried and ground into a fine powder (Breuninger, 2009).

Adding tapioca flour to breadfruit tortilla recipes can change how they feel when consumed. Tapioca flour makes the tortillas softer and more flexible, therefore, it is easier to roll and fold without breaking. It also gives them a chewy texture that is pleasant to bite into. Depending on how much tapioca flour is used, the tortillas might be thicker and heavier. When it is cooked, tapioca flour helps form a delicate crust on the outside while keeping the inside moist and tender. Overall, tapioca flour adds a pleasant texture to breadfruit tortillas, making it more enjoyable to eat (Chatterjee, et al., 2019).

Tapioca starch has been found to significantly impact the properties of tortillas. In the study on the production of a protein-rich extruded snack base using tapioca starch, tapioca starch was observed to increase the expansion ratio and decrease the bulk density and hardness value of the snack. This indicates that tapioca starch can contribute to a lighter and less dense snack with a softer texture (Patel, et al., 2015).

Figure 2.2 Tapioca Starch

2.1.3 Margarine

Margarine offers benefits such as; texture enhancement, moisture retention, buttery flavor, structural support, gluten-free assurance, resulting in flavorful, tender, and pliable. It also offers a plant-based alternative to butter, making it suitable for vegans, those with dairy allergies, or anyone looking to reduce their intake of animal products. Margarine is cholesterol-free and generally lower in saturated fat compared to butter, which can benefit heart health. With its versatility, margarine can be used in various recipes, from spreading on toast to baking and cooking. Plus, its production typically has a lower environmental impact than butter. Widely available in stores, margarine provides a convenient and flavorful option for those seeking plant-based alternatives in their diet (Kim, et al., 2019).

Figure 2.3 Margarine

2.2 Product Review

The fermented breadfruit tortilla is a versatile culinary creation, combining the nutritional benefits of breadfruit with the traditional appeal of a tortilla. Made from fermented breadfruit flour, this thin, round flatbread offers a slightly tangy and nutty flavor and a soft, pliable texture, perfect for wrapping fillings or accompanying various dishes.

Beyond its delightful taste and texture, this tortilla packs a nutritional boost, rich in essential vitamins, minerals, and dietary fiber. Moreover, the fermentation process enhances its digestibility and promotes gut health by introducing beneficial probiotics. Being gluten-free and vegan, it suits individuals with sensitivities or dietary restrictions. Additionally, it is a sustainable choice, as breadfruit is environmentally friendly and thrives in tropical climates. Versatile in its usage, the fermented breadfruit tortilla adds a unique twist to dishes like tacos, wraps, quesadillas, and sandwiches, making it an appealing and nutritious option for health-conscious consumers (Galvis & Sharma, 2020).

2.3 Process Review

2.3.1 Fermentation

Originating from the Latin word "fermentum," the term "fermentation" describes a procedure that makes use of the development, and metabolic processes of microorganisms found in plant or animal matter. (Terefe, 2016)

It involves the chemical transformation or breakdown of complex organic substances or other food components into simpler compounds by the action of naturally occurring enzymes and fermenting microorganisms. The microorganisms involved in fermentation include yeasts, e.g. Saccharomyces spp., Pichia spp., Candida spp (Batt, 2016). All of which reacts to starch where the fermentation starts with the breakdown of starch components into dextrin and sugars, which then gradually transform into alcohol and acids, giving the tapai product its sweet flavor and contributing to its sweetness. (Dr. Masqood & Mueedin, 2021)

The process begins with peeling and cutting unripe breadfruit into small thin slices and grinding tapai yeast. Sprinkle tapai yeast on the sliced raw breadfruit slices then place in a glass container with a cloth covering the top for ventilation, let it ferment for 2 days.

The reason this experiment uses unripe and raw breadfruit instead of ripe and cooked is caused by the fact that partially cooking it only aims to soften the tissue to facilitate microbial penetration and does not necessarily offer other benefits nutrition-wise (Cempaka, 2021). Using raw and unripe breadfruit as the base of the tortilla will give a desired result, which is a neutral flavor profile. The reason being cooking or using ripe breadfruit will give a sweet taste which is not ideal in making a neutral tasting tortilla.

Although cooking the breadfruit before fermentation does not automatically mean it is worse compared to not cooking nutrition-wise but using it raw has its own benefits such as having significantly higher amount of ash, carbohydrates, and fiber content of raw breadfruit compared to its boiled and roasted version (Ezennaya & Ezeigwe, 2023).

Fermentation not only allows extending the shelf life of food, but also brings other benefits, including inhibiting the growth of pathogenic microorganisms, improving the organoleptic properties and product digestibility, and can be a valuable source of functional microorganisms (Skowron, et al., 2022).

2.3.2 Dehydration

After fermentation, dehydrate the breadfruit for 6 hours in 60°C. This is because the optimal drying period for breadfruit was found to be at 60°C for a duration of 100 minutes. This duration was deemed optimal based on the superior appearance of the resulting breadfruit flour (Sari & Lestari, 2017). But because the slices are manually cut therefore aren't as thin ideally, the duration is prolonged to accommodate the thickness and to make sure it has dehydrated completely.

2.3.3 Cooking

Cook the tortilla dough onto a hot pan with a temperature around 200-240°C, for 30 seconds until it browns for both sides. The brown spots are caused by the high temperature, which then causes a chemical reaction between amino acids and reduces sugars that leads to the formation of Maillard reaction which produces flavor and aroma during cooking process

(Tamanna & Mahmood, 2015). Afterwards, take it out of the pan and cover with a damp towel so it won't dry out. The tortilla is ready to be used.