

CHAPTER I. INTRODUCTION

1.1 Background

Celiac disease (CD) and gluten-related disorders have become significant health concerns in recent years, influencing dietary preferences and food choices worldwide. Based on Simon et al. (2017), the latest European Society for Pediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) explained CD is interpreted as a systemic immune-mediated disorder caused by gluten and related prolamins in genetically predisposed individuals. This condition affects approximately 5% of the global population and can manifest with a wide range of symptoms, including bloating, chronic diarrhea, nausea, dermatitis herpetiformis, and nervous system problems (NIDDK, 2020). As awareness of gluten-related disorders has grown, an escalating number of individuals are adopting gluten-free diets to alleviate their symptoms and improve their overall well-being. Consequently, there has been a surging demand for gluten-free products that can match the sensory experiences of traditional wheat-based foods, including the beloved indulgence of cakes. While striving to cater to the dietary needs of those with gluten-related disorders, gluten-free cakes encounter many challenges in achieving the desired texture, volume, and crumb structure. It occurs because gluten compounds in wheat flour play a crucial role in providing the viscoelastic properties that contribute to conventional cakes' appealing softness and mouthfeel (Cappelli et al., 2019). Replacing gluten with alternative ingredients often results in texturally inferior and less palatable gluten-free cakes. In response to this challenge, researchers and food technologists are exploring innovative approaches to elevate the quality of gluten-free cakes. Among the various functional ingredients being investigated, date palm powder has emerged as a promising candidate due to its unique nutritional profile and health-promoting properties.

Date palm powder, obtained from the date fruit (*Phoenix dactylifera L.*), has been a staple food in numerous cultures such as in the Middle East and North Africa for centuries (Halabi et al., 2021). Date fruits' extensive use in traditional diets underscores its cultural and historical significance. Beyond its cultural value, dates contain 70-80% of carbohydrates in the form of glucose and fructose which are also good sources of vitamins, minerals, dietary fiber, carotenoids, and phenolic compounds (Tang et al., 2013). These attributes make date palm powder an appealing ingredient with the potential to enhance the nutritional value and sensory attributes of gluten-free cakes. In addition, dietary fiber can contribute to improving crumb structure, volume, and moisture retention in gluten-free cakes, mitigating the typical dry and crumbly texture often associated with gluten-free baked goods (Arslan et al., 2018). Date palm also offers several benefits such as promoting gut health and aiding in digestion due to the high content of dietary fiber. Furthermore, date palm powder exhibits natural antioxidant properties including flavonoids and phenolic compounds (Abdeen et al., 2021).

Based on CBI (2023), in 2021, France was the largest country in date consumption with 33,500 tonnes in total. The reason is the large diaspora population from date-producing states in North Africa is one crucial factor in France's high consumption volume. The Netherlands has the highest per capita consumption in Europe with an average annual consumption per person of 0.4 kilogram. Date consumption as a snack has a distinct seasonal component throughout Europe. There are often two consumption peaks, the first one is connected to the Muslim community in Europe, which consumes the majority of dates during Ramadan, and winter holidays like Christmas and New Year's Eve also experience a peak. Therefore, this study aims to investigate the effect of date palm powder on the physical and sensory properties of gluten-free cake (GFC).

1.2 Objectives

This study aims to add value to low-grade date palm and determine the impact of date palm (*Phoenix dactylifera L.*) powder (DPP) fortification on gluten-free cakes using 5 different formulations (control, 5%, 10%, 15%, and 20% DPP). This research sought to examine the differences in physical (volume, color, moisture, water activity, and texture (hardness, adhesiveness, springiness, and cohesiveness)) and sensory properties with 9-point hedonic test (color, aroma, texture, taste, and overall acceptability) and just-about-right test (sweetness, texture, and mouthfeel) between formulations. In addition, this study also identifies the optimal concentration of date palm powder that achieves a balance between desired physical and sensory attributes in gluten-free cakes (GFC).

1.3 Research Scope

The research aimed to add value to low-grade date palms and thoroughly understand the physical attributes of gluten-free cakes fortified with date powder by analyzing volume, color, moisture content, water activity, and texture (hardness, stickiness, springiness, suppleness, and cohesiveness). Furthermore, sensory attributes were evaluated using a 9-point hedonic test to determine the likeness score. The just-about-right (JAR) test was used to analyze the hardness, sweetness, and mouthfeel of the samples. The sensory test involved 50 students from Chiang Mai University as untrained panelists.

1.4 Hypothesis

1.4.1 Physical Properties Hypothesis

- H_0 : There is no significant difference in cake volume, color, moisture, water activity, and texture between 5 treatments, namely control, 5%, 10%, 15%, and 20% date powder treatment
- H_a : There is a significant difference in cake volume, color, moisture, water activity, and texture between 5 treatments, namely control, 5%, 10%, 15%, and 20% date powder treatment

1.4.2 Sensory Properties Hypothesis

1.4.2.1 9-Point Hedonic Test

- **H₀**: There is no significant difference in color, aroma, taste, and texture between treatments (control, 5%, 10%, 15%, and 20%)
- **H₁**: There is a significant difference in color, aroma, taste, and texture between treatments (control, 5%, 10%, 15%, and 20%)
- **H₀**: There is no significant difference in overall acceptability between treatments (control, 5%, 10%, 15%, and 20%)
- **H₁**: There is a significant difference in overall acceptability between treatments (control, 5%, 10%, 15%, and 20%)

1.4.2.2 Just-About-Right (JAR) Test

- **H₀**: Control will have the most JAR in terms of sweetness, texture, and mouthfeel between the treatments (control, 5%, 10%, 15%, and 20%)
- **H_a**: 20% date palm powder (DPP) treatments will have the most preferable in terms of sweetness, texture, and mouthfeel between the treatments (control, 5%, 10%, 15%, and 20%)