I. INTRODUCTION

1.1 Background

In specific countries, there is an estimation that noncoeliac gluten sensitivity impacts up to 10% of the populace (Golley et al., 2015). The management of both conditions requires a lifelong dietary restriction of gluten-related proteins found in barley (hordeins), wheat (gliadin and glutenins), oats (avenins), and rye (secalins) (Hardy et al., 2015). Usually conventional gluten-free diets are characterized by their relatively low fiber content, elevated fat levels, and the association with heightened economic expenditures (Tanner et al., 2016). Consequently, the concept of "superfood" emerges as a potential solution, as it promotes foods that are rich in essential nutrients beneficial for diets and the body's metabolic functions. However, it's important to note that a precise legal definition for superfoods is yet to be established (Fernandez-Ros et al., 2022). Recent studies have focused on the inclusion of watermeal as a superfood, given its significant protein content, frequently utilized as a substitute for legumes and soybeans (Zuki et al., 2022).

According to Yahaya et al. (2022), watermeal scientifically known as *Wolffia spp*., holds the distinction of being the smallest flowering plant on earth with characteristic of rootless and free-floating thalli. Researchers have identified 11 known species of Wolffia distributed globally (Park et al., 2021). Thailand, in particular, harbors a significant presence of *Wolffia spp.*, with two specific species identified as *Wolffia arrhiza* and *Wolffia globosa* (Ruekaewma et al., 2015). These watermeal species play a vital ecological role by aiding in water quality improvement. They achieve this by absorbing excessive nutrients like nitrogen and phosphorus from the water (Ruekaewma et al., 2015). However, uncontrolled growth of these plants can lead to issues such as reduced sunlight penetration, depletion of oxygen, and interference with water activities. The watermeal harvest typically possesses approximately 95% moisture content (Hu et al., 2022). A significant proportion of bacterial cells, constituting 60% to 90% of their mass, thrives in high-moisture environments and can compromise food quality (Xie et al., 2021). Consequently, it is imperative to extract moisture from fresh products to hinder bacterial growth and expansion, ultimately prolonging the shelf life of the product (Calín-Sánchez et al., 2020).

Drying serves as a prevalent method for preserving food, and the outcome's quality heavily relies on the chosen technique and process parameters (Martínez-Las et al., 2014). Drying process works by eliminating moisture, the reduction in water activity also results in a notable decrease in weight and volume, ultimately reducing expenses related to packaging, transportation, and storage (Martínez-Las et al., 2014). The hot-air oven is a common and effective method that uses convection heating to dry the material while promoting air circulation around it (Kamiloglu et al., 2016). Nevertheless, there are a few drawbacks to this technique, such as extended drying periods and very low energy efficiency. On the other hand, vacuum drying shows a quicker drying rate and maintains the food's nutritional qualities due to the lower pressures (Suna et al., 2019). However, the drying process in general can significantly alter the physical and chemical properties of plant tissues, potentially affecting the quality and shelf life of the final product (Vidinamo et al., 2021). Moreover, various chemical and biochemical reactions can occur, leading to both desired and undesired changes in attributes such as color, odor, texture, and other properties in the dried product.

In this study, Wolffia powder was processed using a different drying method such as hot-air oven and vacuum drying. Moreover, the effect of drying temperature at 60℃ and 70℃ towards the physicochemical attributes of watermeal powder was observed.

1.2 Objectives

This study aims to examine the different drying techniques such as hot-air oven drying at 60℃, hot-air oven drying at 70℃, vacuum drying at 60℃, and vacuum drying at 70℃ towards the physicochemical characteristics of *Wolffia globosa*. The assessed physicochemical properties include the moisture content, water activity, color, pH, fat, crude fiber, protein, ash, and carbohydrates.

1.3 Research Scopes

Watermeal is increasingly acknowledged for its nutritional value and potential as a sustainable food source. Initially, *W. globosa* underwent both hot air oven drying and vacuum drying treatments, followed by an exploration of temperature variations (60℃ and 70℃) to compare treatment outcomes. Subsequently, the resultant dried watermeal underwent a grinder to convert it into a powder. The physical characteristics of watermeal powder, encompassing the analysis of color, moisture, and water activity. Additionally, an examination of the chemical properties, such as pH, protein, fat, crude fiber, ash, and carbohydrates of the watermeal powder was carried out.

1.4 Hypothesis

- H_0 *(null hypothesis)*: There is no significant difference in the physical properties such as color, moisture, and water activity as well as in chemical analysis such as pH, protein, crude fiber, ash, fat, and carbohydrates of watermeal powder among the different drying methods tested, including hot air oven drying at 60°C, hot air oven drying at 70°C, vacuum drying at 60°C, and vacuum drying at 70°C.
- H_1 *(research hypothesis)*: There is a significant difference in the the physical properties such as color, moisture, and water activity as well as in chemical analysis such as pH, protein, crude fiber, ash, fat, and carbohydrates of watermeal powder among at least one pair of the drying methods tested, including hot air oven drying at 60°C, hot air oven drying at 70°C, vacuum drying at 60°C, and vacuum drying at 70°C.