

CHAPTER I

INTRODUCTION

1.1 Background

Bread is considered to be one of the oldest and most important staple food in the world. It is a source of carbohydrate and dietary fibre while also being rich in vitamins and minerals (Valavanidis, 2018). The main ingredients of bread are flour, water, baker's yeast, sugar and salt, all of which determines the final quality of bread (Yano, 2019). Pan bread is a type of plain bread as it contains no flavourings or fillings. It is made by baking in a loaf pan to give its characteristic shape (Ishida and Steel, 2014). It is one of the most widely consumed type of bread in Indonesia due to its convenience, versatility, and affordability (Pusuma *et al.*, 2018).

Since wheat flour is the main ingredient in bread, an increase in bread consumption means that there is also a rising demand for wheat. Every year, Indonesia imports millions of tonnes of wheat from other countries to keep up with this demand (Saajidah and Sukadana, 2020). In 2019 to 2020, Indonesia imported 10.45 million tonnes of wheat. This value has increased to 11.2 million tonnes from 2021 to 2022 and is estimated to further increase by 1.7-1.8 million tonnes in 2023 (Meylinah, 2022). The dependency on imported wheat is a risk to food security that must be avoided. Thus, the usage of wheat flour can be reduced by utilising local crops to fully or partially substitute wheat flour in bread products (Sitanggang, 2016).

Gembili (*Dioscorea esculenta* L.), also known as lesser yam, is a tuber that belongs to the *Dioscorea* family. Since it is a good source of starch and other carbohydrates, it is widely consumed as an alternative to rice in certain parts of Indonesia (Trimanto and Hapsari, 2015). However, with the current changes in the consumption pattern of Indonesians, the utilisation and consumption of gembili are declining. In order to increase its economic value, gembili can be processed into flour and used as the raw material for various food products. With suitable processing methods, gembili flour can potentially be an excellent wheat flour substitute and a good gluten-free alternative for those with gluten sensitivity (Retnowati *et al.*, 2019).

Gluten is responsible for forming desirable texture and volume in bread. Since non-wheat flours have lower levels of gluten compared to wheat flour, there are challenges with utilising non-wheat flours for breadmaking. This includes decreased sensory attributes such as low bread volume along with poor crust and crumb characteristics, which lead to lower overall acceptability (Bibiana *et al.*, 2014; Trejo-González *et al.*, 2014). Therefore, it is crucial to find suitable treatments that can improve the utilisation of gembili flour for breadmaking.

Heat Moisture Treatment (HMT) involves heating starch granules under low moisture levels for a period of time to achieve structural modification of the granules without damaging their structure. HMT impacts the general properties of starch, which includes pasting temperature, solubility, pasting, swelling power, crystallinity, peak viscosity, and amylose leaching (Ruiiz *et al.*, 2018; Asranudin *et al.*, 2021). Dudu *et al.* (2020) found that the pan bread made with heat-moisture treated cassava flour has retarded amylopectin retrogradation as well as improved

crumb porosity and loaf volume compared to the control bread. Similar results are found by Pokatong and Julista (2022) when using heat-moisture treated sweet potato flour in making pan bread. Thus, modifying gembili flour through HMT may potentially improve the physicochemical and sensory properties of pan bread and increase consumers acceptability.

1.2 Research Problem

Pan bread is a widely consumed type of bread in Indonesia that has wheat flour as its main ingredient. The high consumption of wheat flour based products such as pan bread contributes to Indonesia's increasing dependence on imported wheat. To avoid food insecurity, the usage of wheat flour can be reduced through substitution with flours made from local crops. Unfortunately, the partial substitution of wheat flour with local legume, cereal, and tuber unmodified flour has been unsuccessful due to the difference in flour characteristics and the reduced amount of gluten. Gembili is a starchy local tuber that can also be processed into flour and utilised as a substitute for wheat flour. In the same way, the low amount of gluten in gembili flour reduces the bread loaf volume, which is an important quality of pan bread. Certain flour modifications have been found to compensate for the reduced amount of gluten in non-wheat flours. Previous studies reported that modifying tuber flour using heat-moisture treatment (HMT) improves its solubility and swelling power, thus may increase the bread loaf volume to a certain extent. Although there has been studies on effect of HMT on gembili starch, no studies has been conducted on effect of HMT on characteristics of gembili flour. Thus, this research will investigate the effect of HMT time and temperature on characteristics of gembili flour, as well as effect of modified gembili flour to wheat flour ratio on

physicochemical and sensory characteristics of pan bread prepared using straight-dough method. This research aims that partially substituting wheat flour with HMT gembili flour in pan bread making can maintain or increase pan bread volume.

1.3 Research Objectives

1.3.1 General Objectives

The general objectives of this research were to study the use of heat-moisture treated gembili flour as a substitute of wheat flour in the making of pan bread using the straight dough method and to select best formulations based on pan bread physicochemical and sensory characteristics.

1.3.2 Specific Objectives

The specific objectives of this research were to:

1. Prepare gembili flour modified using heat-moisture treatment (HMT).
2. Determine effect of HMT temperature and time on characteristics of gembili flour; and select best treatments.
3. Determine effect of wheat flour to modified gembili flour ratios on physicochemical and sensory characteristics of pan bread prepared using the straight dough method; then to select best formulations.