

# CHAPTER 1

## INTRODUCTION

### 1.1. Background

In light of the growing healthy eating lifestyle, Indonesian consumers start to shift their preference towards healthier food products (EU-Indonesia Business Network, 2016). This trend also applies to white bread, which in the past few years has been increasingly important in Indonesian diet as exemplified by the rise of its expenditure growth (31.1% in January 2016) beyond rice (-4.1% in January 2016) (Pekerti & Slette, 2010; Suwanto & Yapply, 2017). Bread producers should be able to increase the nutritional value of their products to meet the consumer demand. Red kidney bean, a commonly found pulse in Indonesia, can be incorporated to enrich white bread due to its high protein (19.6 g/100 g bean) and fibre (24.3 g/100 g bean) content as well as low glycemic index (31±5, white bread standard) (Institute of Nutrition, Mahidol University, 2014; Atkinson, Foster-Powell, & Brand-Miller, 2008).

In bread quality, apart from nutritional value, bread physical characteristics are also very important because they directly contribute to consumer's perception of bread freshness and eating experience. Bread of good quality should have high loaf specific volume (bread volume per gram bread), acceptable oven spring (expansion of bread during baking), soft crumb texture, a crumb structure characterized by small shallow crumb cells with thin cell walls, and slow bread staling (hardening of breadcrumb during storage) (Sahi, Little, & Ananingsih, 2014). Ingredient interactions during breadmaking greatly influence bread physical characteristics. Therefore, in the context of improving white bread nutritional value, producers have to pay attention to the bread formulation so that bread physical characteristics are not significantly affected. The consequence is that the utilization of red kidney bean flour to enrich white bread should not considerably change bread physical characteristics.

In the currently available studies, utilization of red kidney bean flour on white bread formulation has yielded bread with improved nutritional values, and red kidney bean flour concentration of 15–20% were recommended (Mannonmani, Bhol, & Bosco, 2014; Bhol & Bosco, 2014). However, all of the resulting bread samples had physical characteristics which signify lower bread quality. Mannonmani, Bhol, & Bosco (2014) found that increasing the flour concentration resulted in reduced loaf specific volume, crumb softness, and overall sensory acceptability. Bhol & Bosco (2014) reached similar results. When scanning electron micrograph of the bread was observed, it was found that protein bodies and starch granules from red kidney bean flour disrupted gluten matrix, causing the matrix not to develop properly (Bhol & Bosco, 2014). Therefore, improving kidney bean flour-enriched white bread quality remains a challenge, and other ways to improve the bread quality should be explored.

Adjusting red kidney bean flour particle size is a possible way to improve the quality of red kidney bean-enriched white bread. In flour production, particle size adjustment is an important aspect during the milling process due to its effect on flour functionality (Campbell, Webb, Owens, & Scanlon, 2012). In wheat flour, particle size greatly influences water absorption capacity, which is crucial to gluten network development (Campbell, Webb, Owens, & Scanlon, 2012; Sivam, Sun-Waterhouse, Quek, & Ferrera, 2010). Particle size also significantly influences the functionality of non-wheat flour, such as red kidney bean flour, in breadmaking (Duodu & Taylor, 2012). However, whether or not the particle size exerts positive effects on bread is greatly influenced by the type of flour (Borsuk, 2011; Borsuk, Arntfeld, Lukow, Swallow, & Malcolmson, 2012). This research aspires to explore the possibility of adjustment of red kidney bean flour particle size to improve white bread quality. To do this, the research aims to investigate the effect of red kidney bean flour particle size and level of substitution (concentration) on white bread physical characteristics.

## **1.2. Objectives**

This research aimed to investigate the effect of red kidney bean flour particle size and level of substitution (concentration) on white bread physical characteristics. Specifically, this research compared physical characteristics of normal white bread with white bread enriched with red kidney bean flour at different particle sizes and concentrations.

## **1.3. Benefits of Research**

This research can be used as a consideration for white bread producers in Indonesia to use red kidney bean to improve the nutritional value of white bread. Additionally, this research lays the foundation for future research on optimizing utilization of red kidney bean in the production of acceptable white bread.

## **1.4. Outline of Subsequent Chapters**

The following chapters include Literature Review (Chapter 2), Materials and Methods (Chapter 3), Result (Chapter 4), Discussion (Chapter 5), and Conclusion and Recommendation (Chapter 6). In Literature Review, the reader will be introduced to key concepts and latest discourses in terms of breadmaking, bread physical characteristics, red kidney bean, the role of particle size in flour processing, and the statistical analyses used in this research. Materials and Methods described experimental design of the research, preparation of materials, and methodologies used to analyze the parameters shown in this research. In Result, the results of the study are presented, and the trends are described. Further elaborations on the results (e.g., comparison to previous studies, possible explanations to the trends) are discussed in Discussion. The last chapter, Conclusion and Recommendation, summarizes key findings, conclude the study, implicate the role of the current study on future research, and provides recommendations to improve this study. Aside from these chapters, a section called Appendix is created to contain supplemental information on the study, such as raw data and statistical analysis results.