

CHAPTER I

INTRODUCTION

1.1 Background of the Study

In recent years, public awareness of the importance of healthy eating has grown significantly, driving increased demand for functional foods made from natural and nutrient-rich ingredients. This trend presents a great opportunity for the development of food products based on whole grains and plant-based protein sources that offer health benefits. One promising ingredient that has gained considerable attention is black rice flour (*Oryza sativa* L. *indica*), due to its rich nutritional profile and functional properties. Historically cultivated in Asia and once consumed exclusively by royalty, black rice is now recognized as a *super grain* because of its high content of anthocyanins—a type of powerful antioxidant that gives the rice its distinctive dark purple color—as well as dietary fiber, essential amino acids, vitamins, and minerals (Suriano et al., 2022).

Unlike white rice, which undergoes refining processes that remove much of its nutritional value, black rice retains its bran layer, where most bioactive compounds and phytochemicals are concentrated. The anthocyanins in black rice have been shown to reduce oxidative stress, lower inflammation, and support cardiovascular health. Additionally, phenolic and flavonoid compounds present in black rice contribute to improved lipid metabolism and protection against chronic diseases such as diabetes and atherosclerosis (Suriano et al., 2022). Based on these characteristics, black rice flour holds great potential as the primary raw material in the formulation of healthy and practical functional cereal products.

However, despite its rich micronutrient and bioactive content, black rice has a relatively low protein content compared to daily nutritional needs. Therefore, to enhance the protein content and overall nutritional value of black rice-based cereal, it is necessary to incorporate other nutrient-dense ingredients—one of which is pumpkin seed.

Pumpkin seeds are highly nutritious and contain high-quality plant-based protein, unsaturated fats, magnesium, zinc, and potent antioxidants such as tocopherols and phytosterols (Ajmal et al., 2024). The high levels of tryptophan and magnesium in pumpkin seeds are also known to improve sleep quality and support proper nervous system function. Moreover, pumpkin seeds promote heart health, help lower blood pressure, and reduce inflammation and the risk of metabolic diseases (Saeedi et al., 2024). These characteristics make pumpkin seeds an ideal complementary ingredient to enrich the nutritional composition and functional benefits of black rice-based cereal.

The combination of black rice flour and pumpkin seeds in a single cereal formulation is expected to yield a functional food product that is high in antioxidants, rich in dietary fiber, and contains enhanced levels of plant-based protein. This formulation not only meets consumer demands for healthy and convenient food products but also aligns with modern dietary trends that emphasize natural, plant-based, and nutritionally balanced food choices. Furthermore, this formulation supports the concept of *clean-label food*, which refers to products made with natural ingredients and minimal processing, free from synthetic additives.

The strategic combination of black rice flour and pumpkin seeds in cereal development is also supported by the growing scientific interest in synergistic effects of functional ingredients. Research suggests that combining diverse bioactive compounds—such as anthocyanins from black rice and phytosterols from pumpkin seeds—may enhance the overall antioxidant and anti-inflammatory activity of a food product more effectively than single ingredients alone. Moreover, this synergy can improve nutrient bioavailability, sensory characteristics, and consumer acceptability, which are critical factors for the success of functional foods in the market. Therefore, this research is not only relevant in terms of nutritional enhancement but also holds significance in advancing food innovation that meets both health-oriented goals and consumer preferences. By scientifically exploring this formulation, the study contributes to the growing field of evidence-based functional food development,

particularly within the context of local ingredients with high health potential.

1.2 Objectives of the Study

The objectives of this study are as follows:

1. Introduce the potential of utilizing black rice—an underappreciated yet nutrient-rich grain—in culinary innovations, thereby promoting its consumption, enhancing dietary diversity, and supporting sustainable food practices.
2. Determine the nutritional composition, packaging methods, and financial feasibility of a product made using black rice and pumpkin seed as a key ingredient.
3. To evaluate the nutritional composition of black rice and pumpkin seeds. This includes analyzing the macronutrient (protein, fat, carbohydrates) and micronutrient (minerals like magnesium, zinc, and iron) content to assess their potential as a functional food ingredient.
4. To investigate the antioxidant and bioactive properties of pumpkin seed extracts.