CHAPTER II
LITERATURE REVIEW

2.1 Ingredients Review

2.1.1 Brown Rice Flour

Figure 2.1 Brown Rice Flour

Brown rice is untreated whole grain and is formed by removing the outermost layers of seed. Mostly rice is taken in milled white form, that is formed by milling and polishing of brown rice which causes removal of the bran from the grain whereas brown rice contains the germ and bran layers, that are rich in nutrients and includes vitamins, dietary fiber, minerals, and some other unmeasured dietary components. As brown rice has bran and embryo, a large variety of bio-functional and nutritional components are present (Zahra & Jabeen, 2020).

Brown rice has immense number of health benefits. Brown rice is also considered as whole grains as it contains all 3 portions e.g. bran, germ and endosperm. Endosperm causes protein production, bran provides almost 80% minerals and germ layer is made up of Vitamin E, unsaturated fatty acids, minerals, antioxidants and phytochemicals (Zahra & Jabeen, 2020).

Table 2.1 Nutritional composition of brown rice and white rice (per 200 grams)

Parameters	Brown Rice	White Rice
Calories	232	232
Protein	4.88 g	4.10 g
Carbohydrates	49.7 g	49.6 g
Dietary fiber	3.32 g	0.74 g
Thiamin (B1)	0.223 mg	0.176 mg
Riboflavin (B2)	0.039 mg	0.021 mg
Vitamin B6	0.294 mg	0.103 mg
Niacin (B3)	2.730 mg	2.050 mg
Folacin	10 mcg	4.1 mcg
Vitamin E	1.4 mg	0.426 mg
Phosphorus	142 g	57.4 mg
Potassium	137 mg	57.4 mg
Zinc	1.05 mg	0.841 mg
Magnesium	72.2 mg	22.6 mg

(Zahra & Jabeen, 2020)

Although brown rice contains several vitamins and minerals, it is only consumed by a limited number of health conscious and nutritionally aware people, probably due to its longer cooking time, instability during storage, strong bran flavor, and undesirable texture (Upadhyay & Karn, 2018). Therefore, many people now process brown rice into brown rice flour which can later be processed into various food products. Brown rice flour is also a gluten-free product so it is widely used by people with gluten intolerance as a substitute for wheat flour-based products (Fitriani et al.,2023)

2.1.2 Mocaf Flour

Figure 2.2 Modified Cassava Flour

Mocaf is a product derived from cassava flour using the principle of cassava cell modification by means fermentation, where the role of microbial enzymes dominates during fermentation. Technically, processing mocaf is similar to processing ordinary cassava flour. However, it is accompanied by fermentation, then dried and ground into mocaf (Anindita et al., 2019).

Mocaf is often used as a substitute for wheat flour in making pastry. The condition of mocaf which is gluten-free can function as a functional food ingredient, especially for sufferers of certain diseases such as people with autism and celiac disease (Triyono et al, 2019). Mocaf flour also contains relatively high fiber and calcium compared to wheat flour (Tabel Komposisi Pangan Indonesia, 2017). However, mocaf flour is low in protein so it needs to be fortified with other ingredients to increase the protein content.

Table 2.2 Nutritional composition of mocaf flour and wheat flour

Parameters	Mocaf Flour	Wheat Flour
Energy	350 kal	333 kal
Protein	1.2 g	9 g
Fat	0,6 g	1 g
Fiber	6 g	0,3 g
Calcium	60 mg	2.2 mg

Phosphor	64 mg	150 mg
Iron	15,8 mg	1,3 mg
Zinc	0,6 mg	2,8 mg

(Tabel Komposisi Pangan Indonesia, 2017)

2.2 Product Review

Cereals are important sector to make Ready-to-Eat (RTE) food products. These food formulations are easy for human consumption and highly acceptable by customer because it minimizes the further cooking at home (Temgire et al., 2021). They are also relatively shelf-stable, lightweight, and convenient to ship and store. (Fast et al., 2020). Consumption of RTE cereal is associated with a healthier dietary pattern, concerning intake of carbohydrates, dietary fiber, fat and micronutrients (Priebe & McMonagle, 2016). While there have been controversies related to the nutritional benefits of RTE cereal, the balance of the published science, coupled with the recommendations within the 2015 Dietary Guidelines for Americans (DGA), support whole-grain fortified RTE cereal as positively contributing to nutrient intakes and overall diet quality (Smith et al., 2019).

Despite its advantages, it turns out that RTE cereal is not suitable by some people because it contains allergens, for example gluten. Therefore, research was carried out to develop a basic recipe formulation for gluten-free cereal. Apart from using brown rice and mocaf flour, this recipe uses margarine (as substitute for butter) and coconut milk (as substitute for dairy milk). It can be concluded that this product also suitable for vegans and vegetarians.

2.3 Process Review

There are several forms of cold cereals that are available, one of them is baked cereal. Baking is a form of cooking performed in an oven. It transforms semi-solid dough into an eatable product under the influence of heat (Arepally et al., 2020). In the early stage of baking, the dough spreads

as a result of gravitational flow and leavening in the oven. At a certain timepoint, the spreading of the dough stops and the shape is fixed. In the final stage of baking, the Maillard reaction and caramelization occur, contributing to the browning color and flavor of the end product (Cheung & Mehta, 2015).