Glycaemic index of instant porridge from parboiled rice flour and mocaf flour fortified with red spinach flour

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Abstract. This research was conducted to determine the glycaemic index value of instant porridge from parboiled rice flour and mocaf flour fortified with red spinach flour by using in vivo testing of rats. In vivo tests were given instant porridge orally with a concentration of porridge of 1.0126 g / 200 g rats BW. The instant porridge prepared from the best formulation, i.e. the ratio of parboiled rice flour of 70%: 30% mocaf flour with the addition of 2% red spinach flour. The glycaemic index value of instant porridge from parboiled rice flour and mocaf flour fortified with red spinach flour was 50.5091.

1. Introduction
Indonesia is one of the countries that mainly of its population had diabetes mellitus. Diabetes mellitus is a disease that occurs due to metabolic disorders, namely blood glucose levels that are above average (hyperglycaemia) due to insulin deficiency [1]. Basic Health Research (Riskesdas) conducted interviews with people with diabetes who found that the proportion of diabetics in 2013 had doubled compared to 2007 in both rural and urban populations. Moreover, the latest estimation of the International Diabetes Federation (IDF), 382 million people developed diabetes in 2013. By 2035, people with diabetes are estimated to be 592 million people. The risk of death for people with diabetes is twice that of non-diabetics [2].

The glycaemic index (GI) is a clue about food to blood glucose levels and insulin response. Foods that can increase blood glucose levels quickly have high GI values. Conversely, foods that increase blood glucose levels slowly have low GI values. Glycaemic index (GI) value of a food is influenced by the content of fibre, fat, protein, amylose, amylpectin, sugar, and osmotic power. The GI values can be classified into 3 groups, namely high GI (GI > 70), moderate GI (70-56), and low GI (GI <55) [3]. Foods with a low glycaemic index are right for people with diabetes mellitus.

In general, rice is a high glycaemic index food (56-78). The process of parboiling in rice is the process of cooking or partial cooking before it becomes rice [4]. Parboiling is one method for changing the physicochemical properties of a material. The parboiling process that is heating followed by cooling can change the structure, and new crystals will form, which are insoluble and can change the glycaemic index value [5]. Mocaf flour is flour made from tubers fermented with microbes. This fermentation process will increase viscosity, gelation ability, rehydration power, and solubility [6]. Mocaf flour is flour made from tubers fermented with microbes. This fermentation process will increase viscosity, gelation ability, rehydration power, and solubility [6]. The properties of mocaf flour can make mocaf flour be as the basis for making porridge. Red spinach is one of the vegetables that contain antioxidants such as flavonoid compounds that neutralize free radicals in the body and prevent degenerative disease; one of them is diabetes mellitus [7].
Based on the above description, parboiled rice flour, mocap flour, and red spinach are ingredients that can be used as ingredients for making porridge and have been shown to have a low glycaemic index value. Therefore, this study was conducted to determine the glycaemic index value of the instant porridge made of parboiled rice flour and mocap flour fortified with red spinach flour, so that it can be used as one of the healthy food choices for individuals to control blood sugar levels, especially people with diabetes mellitus.

2. Materials and methods

Tools used in the glycaemic index test were blood lancet, glucose level analysis strips, and glucometer (GlucoDr. AGM-2100). The ingredients used in testing the glycaemic index were pure glucose, aqua dest, and instant porridge.

2.1 Research methods

The glycaemic index test was carried out by grouping rats consisting of 4 normal rats that were adapted and fasted for 16 hours. A group of mice (2 rats) were given instant porridge orally with a concentration of porridge of 1.0126 g / 200 g rats BW, and another group (2 rats) was given glucose orally with a concentration of 2g / kg body weight of rats. Then, glucose serum level was determined by taking blood through the tail and measured with a glucometer at 0, 30, 60, 90, and 120 minutes after administration. The numbers listed on the glucometer were recorded as rats’ blood glucose levels.

Blood glucose levels at each sampling were spread on two-time axes (X) and blood glucose levels (Y) axis. The glycaemic index was determined by comparing the area under the curve between the test foods measured by the glycaemic index with the reference food, glucose [8]. The glycaemic index calculation formula is:

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\text{Glycaemic Index} = \frac{AUC \text{ Food Test}}{AUC \text{ Glucose (Standart)}} \times 100
\]

Note: AUC = Area Under Curve

Figure 1. Glycaemic index analysis scheme

Figure 2 showed an oral administration of instant porridge, and Figure 3 showed the rat blood glucose level examination.
3. Results and discussion

The glycaemic index is the response of blood glucose levels to certain food intake. Each food will provide a different response to the increase in blood glucose levels. Graphs of blood glucose levels after administration of instant porridge and glucose in various time frames can be seen in Figure 4.
Figure 4 showed that the glycaemic index value analysis of instant porridge from parboiled rice flour and mocap flour fortified with red spinach flour that was equal to 51.5091. The results of the calculation of the value of the glycaemic index of instant porridge can be seen in Figure 5.

Glycaemic index (GI) values can be classified into 3 groups namely high GI (GI > 70), moderate GI (70-56), and low GI (GI < 55) [3]. Therefore, the calculation results showed that the value of instant porridge glycaemic index was classified as low glycaemic index. Low GI food will cause food suspense to reach the small intestine more slowly, so that the absorption of glucose in the small intestine becomes slow and does not increase blood glucose levels [5].

In this study, the use of parboiled rice flour affected the glycaemic index. The process of making parboiled rice using heat could change the functional properties of rice which formed resistant starch; that was the starch which could not be digested so it reduced the glycaemic index of rice [9]. In addition, the use of mocaf flour had an effect on porridge because mocaf flour was a modified starch, and red spinach addition also provided an antioxidant effect on instant porridge so it might have an effect on healing diabetes mellitus.
4. Conclusions
The glycaemic index value of instant porridge from parboiled rice flour and mocaf flour fortified with red spinach flour was 50.5091. The glycaemic index value of the instant porridge was classified as a low glycaemic index which showed that instant porridge can be used as a good food for people with diabetes mellitus or healthy individuals who want to maintain blood glucose levels.

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