

CHAPTER I. INTRODUCTION

1.1 Background

Diabetes mellitus is a metabolic disease characterized by chronic hyperglycemia, a long-term increase in blood sugar levels, and metabolic disorders, especially carbohydrates, due to abnormalities in insulin secretion, insulin action, or both (Ningrum *et al.*, 2017). Insulin dysfunction is caused by impaired or deficient insulin production by pancreatic Langerhans β -cells (Dipiro *et al.*, 2009). Insulin deficiency occurs when pancreatic β -cells are damaged and unable to secrete the hormone needed to control hyperglycemia (Bhattacharya *et al.*, 2019).

Based on data from the International Diabetes Federation (IDF), about 537 million people in the world aged 20-79 years have diabetes mellitus in 2021. The number is predicted to increase to 643 million by 2030 and 783 million by 2045. The number of people with diabetes mellitus is expected to increase as the population ages, reaching 19.9% at the age of 65-79 (Pangribowo, 2020). In Indonesia, about 12 million adults suffer from diabetes mellitus due to improper handling of prediabetes conditions that develop into diabetes mellitus (Santoso, 2011). According to Sharma *et al.* (2013), the increase in prevalence is due to a sedentary lifestyle, high-calorie foods, and obesity.

Diabetes mellitus could be managed with a healthy lifestyle, oral antidiabetic drugs, and exogenous insulin administration (Arief, 2006). However, potent commercial drugs are unaffordable, and the side effect of drugs are also common (Fadel and Besan, 2020). Using medications that contain a mixture of chemicals could

have consequences such as low blood sugar levels in the body, unstable blood sugar levels after meals, and weight gain (Goyal *et al.*, 2014). One alternative to overcoming the development of diabetes mellitus without side effects is consuming functional foods from corm plants. Garut corm, kimpul corm, gembili corm, and gadung corm are some of the inferior local corms that can reduce blood glucose levels. The ability of these corms to lower blood glucose levels is obtained from the bioactive compounds owned by these corms, one of which is food fiber (Saputro and Estiasih, 2015).

The Mentawai taro (*Colocasia esculenta* L.) corm is one of the primary sources of food crops in the Mentawai Islets (Johan, 2017). Mentawai taro corm is the potential to overcome diabetes mellitus. Mentawai taro corm could reduce blood sugar, increase tolerance to glucose and insulin, and reduce insulin levels in mice fed a high-fat diet (Rahmadanti, 2022). Syukri's research (2021) found that Mentawai taro corm could reduce weight, white adipose tissue cell area, and plasma lipid levels in high-fat mice. In addition, Mentawai taro corm is also effective in preventing the development of obesity in mice fed a high-fat diet (Hirwanto, 2022).

The processing of Mentawai taro corm for consumption could be processed in whole flour, fiber, and starch. Mentawai taro corm whole flour contains dominant phytochemical compounds of 9-octadecenoic acid, which has bioactivity as an anti-oxidant ($C_{18}H_{34}O_2$). Mentawai taro corm fiber contains dominant phytochemical compounds of astaxanthin ($C_{40}H_{52}O_4$), 9-octadecenoic acid, and lauric acid ($C_{12}H_{24}O_2$) that have bioactivity as an anti-oxidant. Apart from being an anti-oxidant, astaxanthin compounds also have bioactivity as anti-inflammatories. Mentawai taro corm starch contains dominant phytochemical compounds in the form of 3-octadecenoic acid

(C₁₈H₃₄O₂), which has bioactivity as an anti-oxidant. In addition, Mentawai taro corm starch also has compounds such as astaxanthin and lauric acid (Santoso, 2022; Hirwanto, 2022). Based on the difference in the content of the dominant phytochemical compounds possessed by each preparation, it is suspected that they will provide different effectiveness in overcoming diabetes mellitus. Therefore, studies on the effects of various Mentawai taro corm preparations in whole flour, fiber, and starch need to be carried out to determine how effective each preparation is in overcoming diabetes mellitus.

1.2 Problem Formulation

Based on the background above, the problem formulations that could be studied are:

1. Whether Mentawai taro (*C. esculenta*) corm in the form of whole flour, fiber, and starch could effectively improve random blood sugar levels, fasting blood sugar levels, and glucose and insulin intolerance in alloxan-induced diabetes mellitus mice?
2. Whether Mentawai taro (*C. esculenta*) corm in the form of whole flour, fiber, and starch could effectively improve the histopathology of the pancreas in alloxan-induced diabetes mellitus mice?

1.3 Research Objectives

The objectives to be achieved from this research are:

1. To determine the effectivity of Mentawai taro (*C. esculenta*) corm in the form of whole flour, fiber, and starch to random blood sugar levels, fasting blood sugar levels, and glucose and insulin intolerance in alloxan-induced diabetes mellitus mice.

2. To determine the effectivity of Mentawai taro (*C. esculenta*) corm in the form of whole flour, fiber, and starch to improve histopathology of the pancreas in alloxan-induced diabetes mellitus mice.

1.4 Research Hypothesis

The hypothesis of this study are:

1. (H0): The effectivity of Mentawai taro (*C. esculenta*) corm in whole flour, fiber, and starch do not improve random blood sugar levels, fasting blood sugar levels, and glucose and insulin intolerance in alloxan-induced diabetes mellitus mice.
(H1): The effectivity of Mentawai taro (*C. esculenta*) corm in whole flour, fiber, and starch improve random blood sugar levels, fasting blood sugar levels, and glucose and insulin intolerance in alloxan-induced diabetes mellitus mice.
2. (H0): The effectivity of Mentawai taro (*C. esculenta*) corm in whole flour, fiber, and starch do not improve the histology of the pancreas in alloxan-induced diabetes mellitus mice.
(H1): The effectivity of Mentawai taro (*C. esculenta*) corm in whole flour, fiber, and starch improve the histology of the pancreas in alloxan-induced diabetes mellitus mice.

1.4 Research Benefits

The benefits of this research is expected to provide scientific information about the potential of Mentawai taro (*C. esculenta*) corm as an alternative to prevent metabolic diseases, especially diabetes mellitus and increase the use and economic value of Mentawai taro corm.