APPLICATION OF BUTTERFLY PEA (*Clitoria ternatea*) AS A TEA-LIKE FUNCTIONAL BEVERAGE TO CONTROL BLOOD GLUCOSE LEVEL

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STATEMENT BY THE AUTHOR

I hereby declare that this submission is my own work and to the best of my knowledge, it contains no material previously published or written by another person, nor material which to a substantial extent has been accepted for the award of any other degree or diploma at any educational institution, except where due acknowledgement is made in the thesis.

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ABSTRACT

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Hyperglycemia is a symptom of diabetes which can lead to heart disease which is one of the most common diseases in the world. Hyperglycemia is a kind of non-communicable disease (NCD). The aim of this study was to determine the effects of butterfly pea flowers in the form of tea-like products on controlling blood glucose levels. The butterfly pea tea-like product was applied to 26 participants including diabetics and non-diabetics in which each participant consumed 3 different amounts of dried butterfly pea flower. Fasting blood glucose test was done before the participants consuming sugar source and postprandial blood glucose test was done 2 hours after participants consumed butterfly pea tea-like product. Consumption of dried butterfly pea flower which is only soaked in 250 ml of hot water for 30 minutes can effectively control blood glucose level with the anthocyanin content of 3.3472 mg/g.

Keywords: hyperglycaemia, diabetes, butterfly pea tea, blood glucose, anthocyanin content.

DEDICATION

I dedicate this thesis works to Allah SWT who gave me blessings and strength, to my family who always support me and pray for me all the time, to my respected advisor and co-advisor for thee guidance and help during this thesis work, and my friends for the encouragement given to me, and also to my beloved country, Indonesia.

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CHAPTER 1 - INTRODUCTION

1.1 Background

Blood glucose level is a good indicator to measure health status. There are several risks to human health if the blood glucose is low (hypoglycemia) or high (hyperglycemia). One of the important risks of hypoglycemia which should be considered is brain dysfunction (Marbun and Mardiani, 2016). On the other hand, hyperglycemia is a symptom of diabetes which can lead to heart disease (Huo *et al.*, 2016) which is one of the most common diseases in the world. Hyperglycemia is a kind of non-communicable disease (NCD). The risk factors affecting NCD are family descent, gender, daily activities, alcohol use, as well as can come from unhealthy diet (Lim *et al.*, 2012). Almost all types of food contain carbohydrates that are needed by the body to be able to produce energy. However, if too many carbohydrates are consumed it can cause hyperglycemia when not balanced with healthy daily activities, or there is insufficient insulin for glucose to be converted into energy and stored in the liver and muscles. Thus hyperglycemia is often experienced by people who are overweight or obese (Lim *et al.*, 2012; Kim and Oh, 2013). Therefore, if hyperglycemia is not treated properly, it can become severe and can lead to serious complications requiring emergency care.

Solutions to the above problems are needed, and currently many people in Indonesia are planting butterfly pea due to claims of its health benefits. Bioactive components contained in all parts of butterfly pea are claimed to have a medicinal effect and are able to strengthen organ performance (Mukherjee *et al.*, 2008). One of the claims related to this study is that butterfly pea flower can reduce blood glucose levels so it is suitable for people who have diabetes.

Hyperglycemia can be inhibited by blocking the action of enzymes associated with the production of glucose in the body. Mukherjee *et al.*, (2008) state that ethanol extract from butterfly pea could inhibit the activity of β-galactosidase and β-glucosidase enzymes in the serum of diabetic mice so the blood sugar in mice decreased. Adisakwattana *et al.*, 2012 have proven that butterfly pea extract can inhibit pancreatic α-amylase and large intestine α glucosidase activity. Other studies

have shown that butterfly pea extract can be used as an ingredient to reduce the glycemic index in several types of starch such as potato starch, cassava, rice, corn, wheat and glutinous rice (Chusak *et al.*, 2018). Those studies above may prove that blood glucose levels can be decreased by consuming butterfly pea extract which has been modified into powder and capsule form.

Since Indonesia is a developing country and has an unstable economy, it requires alternative medicine solutions that can be economically affordable for Indonesian citizens. Herbal tea-like products can be easily used as an alternative medicine since a tea bag need only be dipped into water. Therefore, this study will provide information on the potency of butterfly pea tea-like products to control human blood glucose.

1.2 Research Objectives

1. To discover the suitable anthocyanin content of hot air-dried butterfly pea flowers to control blood glucose level.
2. To find out the amount of butterfly pea flowers that can control blood glucose levels.
3. To determine the acceptance of butterfly pea tea-like products as a functional beverage.

1.3 Significance of Study

This research will provide information on whether butterfly pea flower can be used as a functional beverage in the form of a tea-like product to control blood glucose level. This study also provides information on the suitable amount of hot air-dried butterfly pea flower with known taste acceptance so that in the future it is expected that it can help and control blood glucose levels in people suffering from hyperglycemia by drinking tea-like functional beverage products.

1.4 Research Questions

1. How much anthocyanin content in hot air-dried butterfly pea flowers can effectively control blood glucose level?
2. How much hot air-dried butterfly pea flower can control blood glucose level?