CHAPTER I

INTRODUCTION

1.1 Background

Functional food consumption in Indonesia has increased by 5% of the total population in 2014. As a part of functional food, functional beverage consumption has also increased to a total of 72.9 million liters in 2014 (Research and Markets, 2015). The increasing of functional beverage consumption is due to growing health concerns with a more stable economy (KITA, 2013). The health concerns includes degenerative diseases such as diabetes mellitus, neurodegeneration in motor neuron diseases and cancer.

Diabetes Mellitus (DM) is a health condition defined by elevated blood glucose. DM is an important health condition for Indonesia as reported by Kementrian Kesehatan Republik Indonesia (2013), there is 6.9% of Indonesian population suffered from DM and 29.9% suffer from Impaired Glucose Tolerance (IGT). People with IGT tend to become patients of diabetes mellitus. In order to inhibit as well as maintain the DM, herbs that contain anti diabetic and or anti oxidant substances can be used as functional food materials.

It is known that plants in kind of vegetables or herbs and fruits are rich sources of phenolic compounds. Consumption of plants and fruits contributes to the prevention, protection and also management of some degenerative diseases due to their antioxidant activity. Plants as traditional medicine have gained a popular acceptance among consumers (Farombi and Owoeye, 2011).
*Vernonia amygdalina* (VA) is a notable plant that is most widely used throughout the African tropics for both food and medicinal purposes. It is also known as bitter leaf due to its bitter taste. Some studies revealed that there are high levels of antioxidant vitamins such as vitamin A, C, E and riboflavin, and mineral elements (Atangwho *et al*., 2013). In folk medicine, *Vernonia amygdalina* is used as treatments for malaria, diabetes, gastrointestinal problems, hypertension and for the management of diabetes mellitus (Atangwho *et al*., 2013; Farmobi and Owoeye, 2011). Components in bitter leaf are reported to possess good effects for health including anti diabetic activities (Farmobi and Owoeye, 2011). Erasto *et al*. (2007) reported that methanolic extract of *Vernonia amygdalina* showed high activity by scavenging 75-99.3% of the DPPH radicals. Atangwho *et al*. (2013) reported that the IC$_{50}$ of the antioxidant activity of VA aqueous and methanolic extract by maceration is 136.7 ppm and 217.2 ppm respectively. Ong *et al*. (2011) also revealed that 400mg/kg of ethanolic extract of VA showed significant improvement in glucose tolerance test of the streptozotocin-induced diabetic rats.

Green tea is also known to exhibit high antioxidant activity. Dried green tea leaves contain about 10-35% (w/w) polyphenols, which includes mainly catechines, flavanols, and flavanones, which are natural antioxidants. These antioxidants are known to inhibit the oxidation of organic molecules as they interrupt the propagation of free radical autoxidation by donating a hydrogen atom from a phenolic hydroxyl group and create a stable free radical (Xi *et al*., 2011). The polyphenols constituents of green tea are also known to be responsible for its distinctive aroma, color and taste (Senanayake, 2013).
Stevia rebaudiana leaves are used as a non-calorie sweetener as it contains steviol glycosides that have beneficial effects on human health. It is reported to be 250 to 300 times sweeter than sucrose. Stevia leaf has been used traditionally as a treatment for diabetes as they exhibit suppression of plasma glucose levels and increased glucose tolerance (Gupta et al., 2013). Hence, combination of bitter leaf extract, green tea and stevia is expected to prevent or maintain the people with regard to DM.

1.2 Research Problem

There are about 17 million adults in Indonesia suffer from diabetes mellitus. Bitter leaf is a plant used for food and medicinal purposes. However, its usage is limited as folk medicine. Studies revealed that bitter leaf extract possesses anti-diabetic and high antioxidant activity however, the proper extraction method and solvent used for its incorporation into food product have not been determined. Bitter leaf extract is also not yet consumed commercially as a beverage due to their unpleasant bitter taste. Addition of an optimum amount of stevia could give a sweet taste with no calories while green tea could give a rise in antioxidant activity and increase the value of the beverage. These combinations are aimed to result in acceptance of sensory attributes as well as antioxidant and anti-diabetic properties of the beverage.
1.3 Objectives

1.3.1 General Objectives

The general objective of this research is to develop the utilization of bitter leaf (*Vernonia amygdalina*), combined with green tea (*Camelia sinensis*) leaves and stevia (*Stevia rebaudiana*) in the making of a functional beverage.

1.3.2 Specific Objectives

The specific objectives of this research are:

1. To determine the extraction methods included solvent kind that proper in extracting the bitter leaf (*Vernonia amygdalina*) based on its antioxidant and α-glucosidase inhibition activity;

2. To observe the effect of different bitter leaf and green tea ratio and stevia powder concentration on the physical and chemical characteristics of the beverage;

3. To determine the most preferred formula of the beverage based on panelists’ acceptance;

4. To observe the antioxidant activity and α-glucosidase inhibition activity of the best formula of the beverage.