CHAPTER I

INTRODUCTION

1.1 Background

Sponge cake is categorized as foam-type cakes with a low-fat content, making it a healthier option for consumption. It comes with a foam form batter that can be mixed in either multistage or in a single stage mixing (Godefroidt *et al.,* 2019). Sponge cake used both egg white and egg yolk which distinguished them from other foam-type cakes (Godefroidt *et al.,* 2019). This cause egg to be a crucial ingredient in sponge cake making as it provides excellent functional properties that responsible for texture and volume development. Despite the benefits, some people avoid consumption of eggs due to personal dietary preferences such as vegan-vegetarian, egg allergies, religious beliefs, or health concerns. Egg protein allergies are well-known as the second most dangerous food allergies, affecting predominantly youngsters (Mustafa *et al.,* 2018). This sparked a surge in interest in egg replacer to create egg-free products with similar quality towards the original.

Murugkar *et al.* (2016) stated many studies have tried to replace egg protein with various plant and animal proteins, wheat starch, and different hydrocolloids and emulsifiers. Soy milk and soy flour have been reported to perform well as a partial or total replacement of egg in cake due the beneficial functional properties such as emulsification, water absorption, texture improvement, and dough formation (Rahmati and Tehrani, 2014; Murugkar *et al.,* 2016). Whey protein isolate obtained from cheese production has been used to replace eggs in variety of

baked products, including cakes (Ramirez *et al.,* 2016). Mustafa *et al.* (2018) stated that aquafaba, a viscous liquid obtained from chickpea processing, possesses foaming and emulsifying qualities that can be utilized as an egg substitute and has been used in the making of angel food cakes and muffins.

Wheat flour contributes a large portion of sponge cake formulation which provide proteins that aid in the development of gluten that allow batter to trap and hold gas bubbles, giving the sponge cake a light and porous structure. However, many people are intolerant to specific gluten proteins, often known as celiac disease, which is characterized by damage to the mucosa of the small intestine (Anggraini *et al.,* 2017). Furthermore, wheat flour contains low dietary fiber content (2.7%) which frequent consumption of gluten-containing products can increase the risk of developing diseases (Otles and Ozgos, 2014). Due to these problems, there has been a movement in demand for the development of healthier sponge cake incorporates dietary fiber-rich ingredients to improve the nutritional content while keeping the characteristics.

High source of dietary fiber can be obtained from cereals, whole-grain products, and fruit and vegetables, as well as its by-products. The vegetable and fruit processing industries generate many by-products, which are typically discarded or used only as raw material for animal feed (Barber *et al.,* 2020). Prokopov *et al.* (2015) reported that white cabbage outer leaves can be transform into powder and reutilized in food products as source of dietary fiber with 41-43 percent of total dietary fiber content. Hossain *et al.* (2016) stated coconut pulp, a whitish residue from production of coconut oil and coconut milk can be utilized as

a healthier flour to replace wheat flour in baked products due to its high dietary fiber content. Aziah *et al.* (2011) reported that mango pulp and peel flours have a great potential for partially substituting wheat flour in production of baked products, including sponge cake. It was reported that mango pulp and peel contain significant levels of dietary fiber and bioactive compounds that are beneficial to human diets and health. Hussein *et al.* (2019) found that spent coffee grounds which is a by-product from instant coffee production can be used as source of antioxidants and dietary fiber (47%) to enrich the nutritional value of baked goods.

This review aims to study the effect of using different type of egg replacer including aquafaba, whey protein isolates and soymilk powder in sponge cake making towards batter characteristics and physicochemical properties of sponge cake. Furthermore, the review aims to understand the effect of substitution of fiber-rich by-products such as coconut pulp flour, cabbage outer leaves powder, mango pulp and peel flour, and spent coffee grounds towards the physiochemical and sensory properties of sponge cake. This review also done to determine the best egg replacer and fiber-rich ingredients to improve the nutritional, physicochemical, and sensory characteristics of sponge cake.

1.2 Research Problem

Sponge cake is a bakery product made primarily of eggs and wheat flour which responsible for the textural and volume properties. Certain proteins in eggs can induce allergies, whereas wheat flour contains gluten and has a poor dietary fiber level, both of which can increase the risk of disease. As a result of this issue, people are becoming more interested in healthy food options that are egg-free and

high in fiber. By products from fruits and vegetables, which are typically thrown away and underutilized in food manufacturing, can be used as source of dietary fiber in baked goods, as well as helping in reducing number of wastes. Meanwhile, plant and animal proteins which are an allergy-friendly food ingredients can be used as an egg replacement. The replacement of egg into egg replacer and addition of fiber-rich ingredients are expected to produce sponge cake with similar and acceptable characteristics. Moreover, utilization of egg replacer and fiber-rich by-products are anticipated to help in reducing number of waste and produce a healthier sponge cake for consumption.

1.3 Objectives

1.3.1 General Objectives

The general objective of this research is to study the effect of different replacer and substitution of fiber-rich ingredients on the characteristics of sponge cake.

1.3.2 Specific Objectives

The specific objectives of this research are:

1. To study the effect of different egg replacers towards batter characteristics and physicochemical properties of sponge cake.
2. To study the effect of substitution with fiber-rich ingredients towards physicochemical and sensory properties of sponge cake.