CHAPTER I

INTRODUCTION

1.1 Background

Cookies are widely consumed bakery products which are generally made of flour, sugar, and fat. Compared to biscuits, cookies have a relatively softer texture and are chewier due to their high sugar and fat content (Boz, 2019; Hussein *et al.*, 2020). Long term intake of large amounts of food with high fat content can give negative impacts to health including increased weight, obesity, and increased risk of heart disease. Due to the potential adverse health effect, the bakery products having health benefits have attracted consumers who concerns about their health (Hussein *et al.*, 2020; Saeed *et al.,* 2022).

A study on the effect of using dietary fiber or inulin as a fat replacer on the chemical, physical and sensory properties of biscuits have been carried out, such as the use of lotus root flour in biscuit products, wheat flour paste in cakes, and the use of bottle gourd as a fat replacer in biscuits (Saeed *et al.,* 2022). Fat replacers are divided into two categories: fat substitutes and fat mimetics. Fat substitutes are substances that have conventional fat molecules' physical and functional characteristics. While fat mimetics are substances that are able to mimic some of conventional fat molecules' organoleptic and physical properties (O'Connor and O'Brien, 2016). Plant-based ingredients in puree or powder forms contain either lipid, protein, carbohydrate or all three, thus can be utilized as a fat replacer and can

provide some functionalities similar to animal fat but can affect texture and sensory acceptance (Kahar *et al.,* 2021). Plants from the *Cucurbitaceae* family have the potential to be used as a fat replacer as studies have shown that these plants have low fat content, thus lowering down the final product's fat content and some of the member of this family had been used to replace fat in meat based products. For instance, mashed pumpkin that were utilized in production of fish burgers showed to produce burger with lower fat content (Kahar *et al.,* 2021). Another plant that belongs to this family is chayote (Kahar *et al*., 2021).

Chayote (*Sechium edule*), also recorded as *Sicyos edulis* and *Chocho edulis* (Kumar and Kiso, 2022), is a native plant from Latin America and Mexico that is also grown and consumed as a vegetable in Indonesia (Coronel *et al*., 2017). In Indonesia, one of the areas that have grown chayote is Central Java. Chayote can be harvested every 3-12 days. In 2017, there were 225,817 tons of chayote produced, 3 to 5 fruits per kg (Roessali *et al*, 2020). According to Coronel *et al.* (2017), the fruit of chayote has 89.0–94.7% moisture content, 3.3–7.7% carbohydrate, 0.04–0.3% fats, 0.2–1.1% protein, 0.4–7.6% crude fiber, 6.2–7.6% hemicellulose, and 16.4–17.3% cellulose. Chayote is relatively rich in macronutrients, antioxidants, fibers, bioactive compounds, such as flavonoids, alkaloids, sterols, saponins, and minerals. Chayote also contains some properties including antihyperlipidemic, antidiabetic, anti-obesity, antihypertensive, and hepatoprotective (Veigas *et al.,* 2020).

Due to its abundance of supply, cheap prices, and health benefits, yet limited consumption, chayote become a potential commodity that needs to be explored and

applied in a range of products. Chayote has carbohydrate and protein that can serve as fat mimetic while its bioactive compounds may improve the bio-functional properties of the products resulted including its antioxidant activity. The carbohydrate and protein that have the ability to trap water, may provide lubricity and creaminess to the product, thus able to mimic characteristic of fat (Farkye and Guinee, 2017). At the same time, carbohydrate in chayote, such as its polysaccharide possess high antioxidant activity (Pu *et al.,* 2021). Chayote also contains phenolic compounds, vitamins, and amino acids that may improve the antioxidant activity of the final product (Coronel *et al.,* 2017; Pu *et al.,* 2021)

Due to the above reasons, chayote has potential to be used for making cookies with lower fat content and higher antioxidant activity, which may allow people who do not really enjoy chayote or other vegetables to still be able to get its health benefits. Therefore, a study to find the potential application of chayote in cookies is required. It includes a study to find the most suitable particle size and concentration of chayote powder that can be used to replace fats in cookies with the minimal effect on the physicochemical properties of the cookies.

1.2 Research Problems

Cookies are snacks that have been around since the middle-ages and are favored by people around the world, all ages, and on any occasion. Generally, cookies are high in sugar and fat (Suas, 2012; Davidson, 2018). However, long term and high intake of food with high fat content have negative impacts on health.

Therefore, fat replacing ingredients are explored to be utilized in the food industry (Saeed *et al*., 2022).

Some studies have been conducted regarding the use of plant belongs to *Cucurbitaceae* family as a fat replacer. Studies conducted by Saeed *et al.* (2022) showed that bottle gourd can be used as a fat replacement in the production of biscuits and enhancing the product's bioactive compounds and antioxidant activity. Studies conducted by Kahar *et al.* (2021) reported the use of five plants belonging to the *Cucurbitaceae* family, kabocha squash, butternut squash, chayote squash, snake gourd, and bottle gourd, as fat substitutes. Among them, chayote squash was found to yield patties with the lowest fat content.

The use of chayote as a fat substitute for meat products has been studied. However, study regarding the use of chayote as a fat mimetic in bakery products have not yet been done. Therefore, this study was carried out to evaluate the effect of using chayote as a fat mimetic on the physicochemical and the sensory properties as well as the antioxidant activity of cookies. This study was aimed to observe the potential of chayote to produce cookies that are not only delicious but also provide health benefits.

1.3 Objectives

The objective of this study is divided into general and specific objectives.

1.3.1 General Objectives

The general objective of this study is to utilize chayote powder as fat mimetic for the development of cookies with functional value focusing on antioxidant activity.

1.3.2 Specific Objectives

The specific objective of this study were

1. Determine the drying effect on the antioxidant activity of chayote.
2. Determine the best particle size and concentration of chayote powder resulting in the cookies with the highest antioxidant activity as well as acceptable physicochemical and sensory properties.